SCIENCE.

FRIDAY, MAY 30, 1884.

COMMENT AND CRITICISM.

THE despatches from Washington recently contained the following paragraph: "Owing to the failure of congress to appropriate the money asked for to publish the monthly pilot-chart issued from the hydrographic office, and to cover the expenses of the branch offices at the various ports of the Atlantic and Pacific coasts, orders were issued from the navy department to-day to close those offices on the 1st of July next, and to discontinue the publication of the pilot-chart after that date." A disinterested observer might express regret at the necessity of economy so stringent as this, and surprise at so marked a sign of national poverty. His surprise would probably be increased, on reading further, in the news of the same day, the statement that it is proposed in congress, with much probability of success, to remove a former limitation of the pensions act, so as to make valid about fifty thousand claims filed for arrears of pensions, averaging twelve hundred dollars apiece, — a bill for sixty million dollars. An additional amount would be required to provide for similar claims, that would be filed in case this wholesale bill became a law; so that it would involve in the end the expenditure of over a hundred million dollars.

We may well leave it to the economical politicians and political economists to decide whether so considerable a share of the sum lately reported to be in the treasury vaults should be expended on unexpected pensions. It is sufficient for our purpose simply to call attention to the fact that the possibility of the mere consideration of such a pensions-arrears bill is enough to convince any disinterested observer that true economy can have no share in the crippling of the work lately entered on by the hydrographic office. The failure to vote appropriations for this work is a selfish economy, practised in a quarter where those in power hope it may not seriously affect them. The lavishness of the proposed pensions-arrears bill is a selfish generosity, arising less from regard for the pensioners than from desire for the votes they may control. On the basis of special appropriations, the hydrographic office undertook a task that has been well performed, bringing out valuable results, that have been well received; and now, just as it is fully under way, an unfair and undeserved neglect requires its suspension. There is neither propriety nor justice in such arbitrary action.

It happens that a reduced copy, prepared several weeks ago, of one of the charts in question, appears in this number of *Science*, from which our readers may form some estimate of the care expended in its production, and of the value to nautical men of the great amount of timely information presented upon it. It is difficult to understand how a congress that is professedly desirous of reviving and encouraging our shipping interests can wish to discontinue the issue of a set of charts that contribute directly to the safety and success of our merchant marine; or to dis-establish the branch hydrographic offices in several of our larger ports that furnish the most recent and trustworthy nautical information to masters of vessels about embarking, and that gather in and preserve for the best future use the observations of those who have just come ashore from voyages across the seas.

UNQUESTIONABLY, many of our agricultural publications deserve the severe censure which has been bestowed on them for diffuseness, and for a tendency to use padding to an unwarrantable extent; but these two censurable faults are due to the exigencies of the case. Most of these publications are designed for the entertainment, or rather the improvement, of

bucolic readers, and they doubtless serve their purpose: it is, however, a fair question, whether a scientific man has the right to bury his discoveries, or even the confirmatory results of his researches, by giving them only to publications of this character. The wheat may be served up with chaff as provender, if need be; but a portion of the same wheat, judiciously winnowed for presentation in the journals of our learned societies, or in the established periodicals which are widely accessible to scientific men, would doubtless yield a fairer return to science. It is, in short, exasperating to find important facts regarding the structure and the life of domestic animals and cultivated plants published only in the midst of details which are of little interest to any one, except as they may have a remote influence upon possible appropriations by a legislature. We submit, that it is the duty of experimenters, who are obliged to publish in such ephemeral, not to say trashy pages, to present the scientific features of their useful work also in a more worthy manner.

THE account given in our notes, of an engineering work planned in western New York, may serve to convince those cautious legislators who look chiefly for immediate results from the forces which they set in motion, that even so theoretical an affair as a state topographical survey may have direct and practical ends. A large swamp occupies a district that might be valuable agricultural land, and spreads its unhealthy exhalations over the adjoining country. The farmers thereabouts, impatient at the slowness of the outlet-stream in cutting down the rocky barrier that holds up the swamp, ask for state aid to hasten the deepening of the channel. The state surveyor is called to their aid: he examines the ground, and reports that the undertaking is entirely feasible, and that, while thus to discount nature's work will cost somewhat over one hundred thousand dollars, the operation may nevertheless commend itself even to the most careful counter of the cost, for the value of the drained land will be increased over one million dollars.

LETTERS TO THE EDITOR.

The cranial ribs of Micropterus.

IN No. 65 of *Science*, Mr. Shufeldt has called attention to a pair of rib-like structures articulating with the 'base of the occiput' in Micropterus salmoides. He is apparently inclined to refer them to an occipital vertebra. Sagemehl has lately (in the *Morphologisches jahrbuch*) advanced a theory to the effect, that, in the occipital region of all teleostean skulls, there are a certain number of vertebrae which are to be compared to the anterior spinal vertebrae of the elasmobranchs, and which have fused more or less completely with the true coalesced occipital vertebrae; i. e., those corresponding to the vagus branches. Without either condemning or supporting this theory, I may point out, that, even though spinal vertebrae should have been taken up into the skull, there is no apparent reason why their ribs should persist. The ribs of teleosts are ossifications of the internal portions of the myocommata, and on the disappearance of these, consequent on the abortion of the segment, one would naturally expect the disappearance of the ribs also.

I have, unfortunately, not been able to examine a black bass osteologically, and therefore cannot speak with any degree of certainty as to the nature of the structures described by Mr. Shufeldt. There is, however, a very possible explanation for them; and that is, that they are portions or rudiments of the supraclaviculae. In many fish these are two T-shaped structures, the portion corresponding to the perpendicular limb of the T being, in each, horizontal, and articulating with the lower portion of the occipital region; while one end of the portion corresponding to the transverse limb articulates with the pterotic and epiotic, and the other end with the mesoclavicula. If the perpendicular limb were to ossify separately, or if the transverse limb should become rudimentary, a condition would result, apparently similar to what Mr. Shufeldt describes.

This is, of course, merely a suggestion, thrown out for the purpose of arriving, if possible, at a correct identification of these peculiar structures.

J. PLAYFAIR MCMURRICH.

Ontario agricultural college, Guelph, Can., May 13.

A singular optical phenomenon.

The phenomenon described by 'F. J. S.' in *Science*, No. 57, and which I at first thought must have been a binocular phantom image, I now think has been truly explained by Mr. Oliver in No. 63. If so, it is only one of a class, examples of which may be seen on every side. I never pass a picket-fence, with another similar fence beyond, without observing and admiring the broad waves of interference running rapidly in one direction or the other. I never look through two fly-screens, one behind the other, without remarking the tortuous shifting waves of interference, like waves of *watered silk*. A lady's silk veil loosely folded shows the same effect beautifully. Of course, the phenomenon is well known and understood; but I was misled by the fact that 'F. J. S.' described it as in mid-air, and nearer the fly-screen. I suppose it may be imagined at any distance, but is usually referred to the plane of one of the objects.

JOSEPH LECONTE.

Berkeley, Cal., April 28.

Popular names of California flowers.

A botanist, coming to the Pacific coast, may be surprised at the large number of plants that are generally

known by their true scientific names. This is the case with Eschscholtzia, Romneya, Clematis, Isomeris, Silena, Malva, Ceanothus, Hosackia, Ribes, Phacelia, Gilia, and many others for which the generic name has become a popular name.

This is owing to various causes, one being the difficulty of applying the old familiar garden names; which are used, however, when any resemblance can be traced, as is the case with larkspur, honeysuckle, columbine, etc. Many of the settlers have also become familiar with the true names of these flowers by having received them from parties that have introduced them to cultivation, for which the greatest credit is due to the late James Vick.

Many visitors, as well as settlers, seek to learn the names of the many strange and beautiful flowers, that, by massing, become such a feature in the scenery, and find the 'dry' scientific names as easy to learn, and as sensible, as the old Spanish names, but few of which survive in the popular mind. Thanks to the little botany of Volney Rattan, largely supplemented by visiting and amateur botanists, all are enabled to learn the more common species with comparative ease. C. R. ORCUTT.

The use of the method of rates in mathematical teaching.

In the case of the question, "Does change in the rate of motion take place at an instant, or during an interval?" I am surprised to find that Professor Wood (*Science*, May 16) regards my amendment as only increasing the difficulty. It may be that I have been misunderstood: permit me, therefore, to answer the questions which the professor goes on to ask in illustration of this difficulty. Assuming (of course, correctly) that my answer to the question is, that it takes time to produce a change in the rate of motion, he asks, "How long is this interval?" I answer, "As long as you please usually: of course, the longer the interval, the greater the change." — "If ever so small, is the rate variable during the interval?" — "Certainly." — "If variable, the original question arises, and we wish to know if *change* involves *a part* of the interval." — "Of course, a part of the change takes place in a part of the interval, and the rest of the change takes place in the rest of the interval." — "Does change in the rate take place at 'a point' in the path, or during 'a space' of the path?" — "During 'a space' of the path; that is, while the point is passing over a space of the path." — "If at 'a point,' is it not equivalent to asserting that a change takes place in no time? [Most certainly it would be, but we do not assert this at all.] And if an interval is necessary, must it not be conceived as infinitesimal?" — "By no means: if you want a finite change, and that is what is usually meant by a change, you must take a finite interval of time; but, if you insist on introducing the conception of an infinitesimal change, you must admit also an infinitesimal interval of time." Let us put precisely parallel questions with respect to the *position* of a moving point. Does change of position take place at an instant, or during an interval? During an interval. How long is this interval? That depends upon the amount of change of position you desire to produce. If ever so small, is the position of the point variable during the interval? Certainly, if the point moves. Does change of position take place at a point in the path? Certainly not: a point has position, but no magnitude.

If there is any difficulty in conceiving the velocity of a point to be continuously variable, there is precisely the same difficulty in conceiving the abscissa of a point moving on the axis of x to be continuously variable; in other words, in conceiving the possibility of motion itself. It should be remembered that the definition of the measure of a variable velocity, presupposed in this discussion, is simply that which we find in such treatises as Tait and Steel's Dynamics of a particle: "Velocity is said to be variable when the moving point does not describe equal spaces in equal times. *The velocity at any instant is then measured by the space which would have been described in a unit of time, if the point had moved on uniformly for that interval with the velocity which it had at the instant contemplated.*" WM. WOOLSEY JOHNSON.

Annapolis, May 19.

Pleuracanthus and Didymodus.

In your issue of April 11, my friend Professor Gill communicates his views on the relationships of Pleuracanthus and Chlamydoselachus, and endeavors to correct some of my opinions and statements. On some points I stand corrected, thanks to Professor Gill's superior knowledge of the literature of the subject. However, as Professor Gill has not seen my material, nor the paper which I read before the Philosophical society upon it, I may, in turn, enlighten him on some important aspects of the case.

Professor Gill objects to the identification of the genera Didymodus and Chlamydoselachus on the sole ground of the diversity in the form of the teeth. He probably has other reasons for objecting; but, with his usual magnanimity, he has not used his most effective weapons. He doubts the pertinence of the recent and extinct genera to the same order. He points out that the oldest name of the genus called Diplodus is Pleuracanthus, and that my order Ichthyotomi has been already defined and named by Lütken as the Xenacanthini.

On these positions, I make the following comments:—

1. There is no generic difference to be detected, in my opinion, between the teeth which are typical of Diplodus Agass. and Thrinacodus St. J. and W. and the recent Chlamydoselachus. Differences there are, but apparently not of generic value. The identification of the recent and extinct genera rests, as far as this point goes, on the same basis as that of the recent and extinct Ceratodus.

2. At the time of my proposal of the name Didymodus, I was not convinced that fishes of this type bore the spines referred to the genus Pleuracanthus Agass. None of the authors cited figure any specimens which present both tricuspidate teeth and a nuchal spine. None of my ten specimens possess a spine. However, Kner describes two specimens as exhibiting both tricuspidate teeth and a spine, and Sir P. Egerton's statements (*l.c.*) on this point are positive. So we must regard Pleuracanthus as the name of this genus, with Diplodus as a synonyme.

3. Diplodus being regarded as a synonyme of Pleuracanthus, it follows that Chlamydoselachus Garm. is distinct on account of the *different structure of the dorsal fin*, which is single and elongate in Pleuracanthus, according to Geinitz and Kner. The presence of the nuchal spine in Pleuracanthus is also, probably, a character of distinction, although we do not yet know whether such a spine is concealed in Chlamydoselachus or not.

4. The identity of Didymodus (type, Diplodus compressus Newberry) and Pleuracanthus may now be questioned. None of the specimens are figured and described by the authors above cited, as displaying an occipital condyle, or posterior frontal cornua. My specimens of Didymodus compressus do not exhibit

teeth on the roof of the mouth, as Kner describes. There are no spines with the crania, although separate Pleuracanthus spines are not rare in the same beds. The teeth associated with the skulls, moreover, present a button on the superior side of the root. Agassiz figures teeth of this kind as belonging to the Diplodus gibbosus. St. John and Worthen make these teeth typical of Diplodus, and confer the name Thrinacodus on those without the button. The button is, however, probably only a specific character. The latter name is, then, probably a synonyme of Pleuracanthus. The button-bearing teeth are figured and described by Kner as occurring scattered, and at a somewhat different horizon from that of the Pleuracanthus specimens. In Germany, as in Texas, the button-bearing teeth are the larger. I suspect that the skulls I describe represent a different genus from Pleuracanthus proper. This genus will not differ from Chlamydoselachus Garm., so far as we know the latter; but the button indicates another species.

5. Of course, a study of the anatomy of Chlamydoselachus, which I hope Mr. Garman may soon give us, may reveal differences between that genus and Didymodus; but of these we know nothing as yet.

6. The order Xenacanthini was proposed by Geinitz (Dyas) for Pleuracanthus on account of the supposed suctorial character of the ventral fins. This character is supposed by Kner to be sexual. In any case, this division, whatever its value, must be subordinated to the order Ichthyotomi, as I define it.

E. D. COPE.

THE GOVERNMENT, AND ECONOMIC ENTOMOLOGY.

A FOURTH bulletin of the entomological division of the department of agriculture has just appeared, containing four reports, either by persons not closely connected with the department, or by its *attachés* sent on special missions, together with extracts from the miscellaneous correspondence of the division. The latter is of variable and generally insignificant value, and would have better been printed in small type: it might have been further curtailed by the omission of some absolutely worthless verbiage, though we recognize that less extraneous matter appears than has been customary in the reproduction of similar correspondence in the annual reports. Of the special reports, the most valuable is that of Mr. J. B. Smith on hop and cranberry insects, of which he mentions seven or eight species as attacking each plant. The least valuable is Mr. Branner's report of his mission to Brazil in the interest of the division. Being, apparently, only a temporary document, and valuable almost entirely for departmental purposes, it was quite unnecessary to publish it: on the other hand, if this is all that is to appear, his expedition must be deemed a failure.

The issue of these bulletins — an innovation in the practice of the department — indicates a laudable intention, on the part of the commissioner, to publish with promptness reports of its special agents upon particular topics. Since this cannot fail to stimulate those engaged in its work, and to enhance the value of the division in the eyes of our large agricultural population, it deserves commendation. We venture to suggest that the plan could be improved by issuing the bulletin at stated intervals, and making it a periodical, to which contributions from all quarters should be invited. All the entomologists of the country might thus become collaborators of the department without further cost to the treasury than the publication of the results of their researches: it would prove a credit to the bureau, a vast encouragement to economic entomology, and a boon to our agriculturists. The former experience of the present head of the division renders him an eminently fit person under whom to inaugurate such a plan.

In few countries in the world would such a plan be more desirable, more advantageous, or more likely to succeed. Covering, as our country does, a wide extent of fertile territory subject to most varied climatic conditions, and hence embracing unusual diversity of economic problems, our people are at the same time extremely ready to contribute their knowledge or experience, without compensation, for the public weal. Americans are not always anxious for precedents; yet, if precedent is demanded, the *Annales de la science agronomique* (just published under the auspices of the minister of agriculture), the various reviews, such as the *Revue des sociétés savantes* and the *Bibliothèque de l'école des hautes études* (long published by the minister of public instruction), together with the *Revue maritime et coloniale* (issued under the direction of the minister of marine), show what France alone has done, in similar ways, for science and industry during the past twenty-five years. It is time our government supported similar aids to material and intellectual growth.

In harmony with this plan, a further extension of the work of the division would prove desirable. Why would it not be feasible to district the country (omitting the sterile portions) into, say, half a dozen great areas, based on the geographical distribution of the main agricultural products and on climatological factors, and permanently locate, at some convenient centre in each, skilful assistants of the division to study *on the spot* the history and devastations of noxious insects? It is as impossible to do this work at Washington as to do that of the coast-survey or the geological survey, each of which has permanent establish-

ments in various parts of the country. A skilled entomologist at such a centre, with one trained assistant whom he might despatch to study local problems not far distant, would accomplish more than twice that number could on the border of the continent, whence the assistant must often travel many thousand miles to reach a field requiring investigation, and be able to remain there only a brief period. The state entomologists are not numerous enough to affect the question in the least. Illinois and New York alone support officers who are doing a really creditable work; and these great states, rich, populous, and fertile, would be insufficiently served, under this scheme, without the aid of their own officials.

This would require a doubled, perhaps a trebled, appropriation for the division. What of that? Its work should be measured, not by what it has been able to do with insufficient means, but by its inherent importance to the largest and most wide-spread industry in the country. A trebled allowance, multiplied a thousand-fold, would not equal the losses yearly sustained by agriculture, reasonably to be classed as avoidable by means which the study of their causes will reveal. The work of the division for the past six years has been admirable, as far as it has gone: it has gained the approval of those who know what scientific work is, and the appreciation of the great class who have seen its practical benefits. It is time to ask, and to grant, the means for a forward step.

RECENT GEOLOGICAL OBSERVATIONS IN THE CANADIAN NORTH-WEST TERRITORY.[1]

IN a former number of *Science* (i. p. 477) a note was given on some points relating to the glaciation of that part of the North-West Territory which occupies the angle between the eastern base of the Rocky Mountains and the 49th parallel. During the summer of 1883 the examinations necessary for the production of a proximately exact geological map, covering an area of over twenty thousand square miles in this district, have been completed, and the mapping of the contiguous area to the eastward has been begun. A number of new facts of geological interest have been brought to light during the prosecution of the work, a few of the more important of which it is proposed here briefly to mention.

In the article above alluded to, the great elevation at which Laurentian and Huronian erratics occur near the mountains was specially noted; and some of the greatest heights up to that time observed were stated as 4,200, 4,390, 4,660 feet, respectively, above the sea-level. In August last, however, several indubitable Laurentian bowlders, representing different characteristic varieties of gneissic and granitic rocks, were found at an elevation of 5,280 feet, at a point in the foot-hills about twenty miles north of the 49th parallel. The ridge upon which these occur lies within a few miles of the paleozoic rocks of the mountains, and, like many others in this vicinity, is evidently a slightly modified moraine, due to the local glaciers of the mountains. The bowlders are associated with many blocks derived from the neighboring mountains. They cannot, however, have come from the Rocky Mountains, as a tolerably complete examination of the range, between the 49th and 51st parallels, has confirmed the statement, previously made in a more general way, as to the absence of crystalline rocks in the constitution of the range: their origin must therefore be sought, with that of the immense profusion of similar erratics strewn over the neighboring lower country, to the east or north-east, in the great Laurentian axis.

In the Cypress Hills (latitude 49° 40′, longitude 110°), which constitute an isolated, high plateau of irregular form, Mr. R. G. McConnell has noted some interesting points connected with the limit in height of the drift and bowlder deposits. The western end of the hills is highest, and is flat-topped and regular in form; while the eastern and lower part has been worn down to an irregular, rounded, and rolling plateau, on which numerous Laurentian and limestone bowlders, resembling those generally scattered over the plains, occur. The highest point at which these were found is 4,340 feet above sea-level; while at 4,400 feet, and other points exceeding this elevation, no such erratics occur. From the observations first referred to, it is certain that this, though locally the upward limit of the glacial deposits, is surpassed by that of other places farther to the west; and it adds to the evidence already obtained, indicating an unequal depression of the plains in glacial times.

In these hills another very interesting discovery has been made by Mr. McConnell; viz., that of the occurrence of considerable outlying areas of an upper tertiary formation of miocene age, consisting, in large part, of rolled shingle which has been derived entirely from the harder rocks of the mountains. The peb-

[1] Communicated, in advance of publication of report, by permission of the director of the Geological survey of Canada.

ble-beds, or conglomerates, are frequently composed of stones several inches in diameter; and as they occur at a distance of over two hundred miles from their nearest possible source, and no signs whatever of ice-action appear, the problem of their mode of transport becomes a difficult one. A few vertebrate remains obtained from these beds appear to be referable to Brontotherium.

It may be mentioned, in this connection, that the discovery of these tertiary pebble-beds to some extent tends to modify statements previously made, respecting the origin of somewhat similar shingle-deposits of later date in this vicinity. The transport of a portion, at least, of the quartzite shingle immediately underlying, and apparently attached to, the bowlder-clay, may have occurred in the miocene period, and its denudation and rearrangement been effected in early glacial times. Of the older formations in this part of the north-west, the following classification has been adopted: —

Laramie.	Porcupine-Hill beds. Willow-Creek beds. St. Mary River beds.
Cretaceous proper.	Fox-Hill sandstones (inconstant). Pierre shales. Belly-River series. Dark shales, supposed to underlie the above.

The subdivisions of the Laramie appear to be of local importance only, but are useful in the region here specially referred to, on account of the very great thickness of that formation. The upper part of the Belly-River series evidently represents the pale, sandy beds which occur on the Missouri in a similar position with reference to the Pierre; and the latter holds coal or lignite at the base in this district, as described by Prof. E. D. Cope on that river. In 1881 the lower portion of the Belly-River series, characterized by yellowish and brownish tints, was found to be highly fossiliferous, and to hold shells like, and in some cases conspecific with, those of the Judith-River group. In consequence of this fact, some doubt was felt in accepting the evidence of the apparent stratigraphical position of this portion of the series; and a re-examination of the district was made with the object of deciding this point. The result of this further investigation has been, however, to confirm the views first held by much additional stratigraphical evidence, which cannot here be detailed, and, further, to prove the existence in the upper or pale beds of the Belly-River series of a molluscan fauna of the same kind with that characterizing the yellowish beds above referred to. The sections are such that no doubt could at any time be entertained with regard to the relative positions of the Pierre and the pale beds.

The composition of the cretaceous, here found to obtain, is thus brought into exact parallelism with that clearly proved in the Peace River country (Report of progress, 1879–80), where a similar important estuarine series, with Laramie-like fossils, follows the Pierre in descending order. The fossils of the Belly-River series have not yet been critically examined; but their resemblance to those of the Judith River is so complete, that I am strongly inclined to revert to Messrs. Meek and Hayden's original views respecting the stratigraphical position of the latter beds,[1] and to suggest, though with some hesitation, that the species figured on plates 37–39 of Meek's work on the cretaceous and tertiary fossils of the Upper Missouri, as from a peculiar local development of the Fox-Hill group, have really been derived from beds underlying the Pierre. One at least, of these fossils (Mytalus subarcuatus), has been found in our district in this position.

The occurrence, among the paleozoic rocks of the portion of the Rocky Mountains between the 49th parallel and Bow River, of extensive cretaceous areas on both sides of the main watershed, is an interesting addition to our knowledge of the range, and important because of the contained coal-seams, which vary in character from bituminous and coking coals to anthracite. A coal of the latter class, containing eighty-six per cent of fixed carbon, was found last summer in the valley of Cascade River, on the Upper Bow; and mining operations have already been commenced on it. The trough of cretaceous rocks is here comparatively narrow, and the beds very sharply folded.

Space will not permit any detailed notice of the investigation of the paleozoic rocks of the mountains. It may be stated, however, that the limestones appear, for the most part, to be of Devonian age, and are very variable in thickness. One measured section on the Crow-Nest Pass showed a thickness of ninety-six hundred feet. They are unconformably underlain by a great series of slaty and quartzite rocks, from which no fossils have yet been obtained in place. On the evidence of detached fossiliferous fragments, they are, however, provisionally referred to the Cambrian, and closely resemble, lithologically, those of this age in the Grand Cañon of the Colorado.

George M. Dawson.

Geological survey of Canada, Ottawa.

[1] *Proc. acad. nat. sc. Philad.*, 1857, p. 114.

FIVE BRAZILIAN DIAMONDS.

AT the International exposition held at Amsterdam during the summer of 1883, was exhibited a suite of wonderful round diamonds, that, for their size and merit, were awarded the prize for 'round bort.' They were purchased by a New-York firm, who offered them to Messrs. Tiffany & Co., and, on examination, were found as follows: —

They are of Brazilian origin, four in number, and all as round as marbles. In this form they can be used for drilling-purposes to equally good advantage with the black amorphous carbonado, as the intricate twinning or compounding destroys the easy cleavage property that renders ordinary crystals unfit for this purpose.

No. 1 (fig. 1), the largest diamond, is entirely round, of a light vitreous brown color, and translucent; its entire surface being covered with small re-entering angles, giving it the appearance of the fibrous, or, rather, bunched crystals of acicular rutile, variety nigrine, from Magnet Cove, Ark. These markings, numbering hundreds, are over the entire surface, and render it very evident that the crystal is the result of a multiplicity of twinnings of cubic crystals, as is often the case with iron pyrite. It is 17 millimetres in diameter, and weighs 8.542 grams ($41\frac{3}{4}$ carats); specific gravity is 3.51954.

No. 2 (fig. 2) is entirely round, of a milky gray color, and translucent. To the eye the surface appears quite smooth; but under the glass the same markings show, on a smaller scale, as in the large diamond, though the surface is duller. It is 10 millimetres in diameter, and weighs 2.0815 grams ($10\frac{7}{32}$ carats); specific gravity is 3.522.

No. 3 (fig. 3) is almost entirely round, of a milky, translucent white, no crystalline markings being visible, and has a fused vitreous appearance, as if it had been originally round, with small pit-markings, and then the entire mass fused, thus nearly obliterating the pitting. It is 9 millimetres in diameter, and weighs 1.289 grams ($6\frac{3}{8}$ carats); its specific gravity is 3.5218.

No. 4, the weight of which was 1.478 grams, and its specific gravity 3.649, proved, on examination, not to be a diamond, but a red hematite sphere that had been rolled, and was evidently a pseudomorph after limonite or some other like mineral, or was filled with air-cavities (see low specific gravity). Not coming into ownership of it, I could only try the surface, whereas, if it could have been broken, more definite results might have been arrived at.

It seems very remarkable, however, that this specimen, having been viewed by the majority of the Amsterdam diamond-dealers, examined by the judges and experts, and then passed through the hands of several old and experienced importers of diamonds, should have deceived them all. So perfect was its color and lustre, that even a diamond-cutter, when informed of the facts in the case, was not convinced until he had tried the stone on the wheel.

Another curious diamond (figs. 4 and 5) is now in possession of Messrs. Tiffany & Co., weighing $6\frac{3}{32}$ carats, the original weight of which was $10\frac{1}{2}$ carats, 4 carats having been lost

FIG. 1.

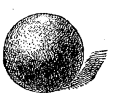


FIG. 2.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

in cutting. This stone has eighteen facets, of which four, of the top and the table, are white, and four are a distinct black; on the back, four facets are white, and the other four and the culet are black. The stone was found to be excessively hard, much above the average of hardness, in fact; and, although apparently poorly cut, the cutter had sustained a loss, owing both to the longer time required in the work, and also to the fact that he was remunerated at a certain rate per carat. This diamond is of Brazilian origin, and was originally an octahedron. When found, the entire stone was a jet black, and it was cut with the intention of producing a black stone. After the table had been put on one of the points, and the four edges of the octahedron had been removed to make four facets, it was found that the black color was only a superficial coating, and that the inside of the crystal was entirely white, with the exception of an occasional carbon inclusion. It shows no more play of color than a black stone, but gives very decided brilliant metallic reflections. The curious effect of five white and four black reflections, and the appearance of a clearly defined Greek cross in black outline, when viewed by transmitted

light, make the stone a remarkable freak of nature; and not a little interest is added to it by the fact that its strange features were so well developed by mere accident.

Among curiously marked diamonds resembling the above, may also be mentioned the two presented to the Jardin des plantes by Halphen, and described by Descloizeaux (see *Poggendorff's annalen*, 1849, ix. p. 447).

These stones are colorless and round, and a distinct three-leaved clover in black occupies the entire dimension in each stone. Another in the Duke of Leuchtenberg's cabinet, now in the Bavarian state cabinet at Munich, has three leaves united by a circle. All these three are of Indian origin.

A curious diamond (fig. 6), also in the possession of Messrs. Tiffany and Co., is a red brilliant, that at first glance appears brown, while through it a beautiful dark rose-red light breaks in every direction: really, therefore, it is a red brilliant, or combination of red and brown; or, more correctly, a red diamond with a brown cloud, the red predominating as the stone is turned, or the light strikes it in different directions. This change of color gives the stone its dichroitic effect, although no effect is produced in viewing it by the dichroscope.

By artificial light it appears brown; but the entire stone throws out bright red reflections, such as are produced by the diamond only.

One-half of the stone is filled with hundreds of irregular-shaped cavities, either empty, or filled with a transparent fluid, or, as in nearly all cases, with carbon, which in some instances is in pieces, or so fractured as to admit the light through it. These inclusions appear to affect the color sufficiently to produce the brown appearance.

Light seems to be very faintly restored under the crossed Nichols prisms, in addition to that produced by the cutting of the gem. The specific gravity is 3.5696. GEORGE F. KUNZ.

THE DISTRIBUTION OF COMETS WITH REFERENCE TO SOLAR MOTION.

THE regions of space outside the solar system furnish a supply of comets which seems to be inexhaustible. Their origin is simply a matter for speculation; and it is not reasonably to be expected, that, even with the large amount of attention being given to cometary investigation, any definite information upon this subject can be attained for centuries to come. There is no probability that any considerable number of them have had their origin in the mass which has gone to form the solar system.

Between six and seven hundred comets have been recorded; and if we take the large proportion of telescopic comets which have been discovered when searching has been vigorously prosecuted, to the number visible without the aid of a telescope, it would not be an exaggerated estimate to place the number of comets which have come into our system since the beginning of the Christian era, under such conditions as to have been visible by the aid of our modern appliances, at four thousand.

Undoubtedly there are many, which, either from their small size and faintness, or from the unfavorable positions of their orbits, never could be seen. Were the orbits of all these known, the discussion would furnish some reasonable basis for an hypothesis in regard to the origin of the comets themselves; and light would be thrown upon other problems concerning the system of the universe.

While the sun, drawing all bodies within its influence towards itself, swings the comets into orbits which may bring them, at some point, almost into contact with the sun's surface, or, on the other hand, never within the confines of our planetary system at all, the motion of the sun itself must have an influence upon the position of these orbits. The limited amount of material at hand furnishes some features which are at least suggestive.

There are two hundred and eighty-five comets, which, up to the present time, have had their orbits determined with greater or less exactness. The axes of the orbits lie in the directions along which the comets come to the sun.

The table exhibits the grouping of the points which represent the directions of the origins of these comets about that point which investigation has indicated as the direction to which the solar system is moving.

The method of making the reductions will be apparent. The elements were reduced to 1850, and the longitude and latitude of the perihelion point computed for each comet. The point directly opposite this was then reduced to a new system of co-ordinates, having the direction of solar motion, as the pole.

The point toward which the sun is moving is taken at longitude 256°, latitude +57°.

For convenience this may be referred to as the north pole of the new system; and the hemisphere surrounding it, as the northern. This hemisphere is then divided into ten zones of equal area, the most northern surrounding the pole, while that at the base may be called the equatorial.

The southern hemisphere is similarly divid-

ed, and in the table the figures in the top line are for the north and south polar zones.

Those adjoining each are given next, so that the lower line contains the zones immediately north and south of the equator. Zones on the same line are at the same distance from the north and south poles respectively.

The columns give the number of comets whose points of apparent origin fall in each zone, and the mean of the perihelion distances of the group.

NORTH.		SOUTH.	
No.	Mean perihelion distance.	No.	Mean perihelion distance.
9	0.730	16	0.599
8	1.022	13	0.713
13	0.745	14	0.715
12	0.700	13	0.526
15	0.838	28	0.795
14	1.010	11	1.008
20	0.821	17	0.813
11	0.903	10	1.091
19	0.767	12	0.789
15	0.762	15	0.912

So many conditions that will readily occur to any one come in to affect the number of comets discovered, and, to a certain extent, the discovery of those coming from any particular quarter, that the collection of so small a proportion cannot give much satisfaction. It will be noticed that the zones farthest south have a larger number than the corresponding zones north, while near the equator this difference is reversed.

The mean perihelion distances, taking the columns separately, vary in such a way that there is little encouragement for discussion as a whole.

But taking the corresponding zones in the two hemispheres, the comparison is interesting, if not instructive. The first seven from the north pole, or direction of solar motion, downward, have greater mean perihelion distances than those in the southern hemisphere similarly situated. The equatorial zones, where the distinction would not be so great, have an opposite difference.

With the same data combined in other proportions, the differences will be found to confirm the tendency shown by this division. Thus doubling the area of the zones, making five northern and five southern, the excess of mean perihelion distances of the north over the south exists in the three polar sets. Comparisons can also be made by fours and fives, and also by combining the two adjacent to the polar zones, the three next following these, and finally the four next north and south of the equator. Any one can make these comparisons with small uncertainty, from the table.

The most satisfactory confirmation of the tendencies here indicated is found in the discussion of the comets of the last hundred years only. These have been well observed in general, and the number does not contain so large a proportion of anomalous orbits. The table above includes all, probably, that have been computed; but, in summing up, notice was taken of the effect of the unusual cases, like the large perihelion distance of the 1729 comet, and the combination of several very small distances in one zone; and in no case would the sign of the compared difference have been changed by the omission of any extraordinary comets.

For the one hundred years the numbers in the zones are more uniform, with a similar tendency to that above.

In the comparison of perihelion distances by zones, seven of the northern exceed the corresponding southern.

The general results may be summed up in a few lines. There is an indication that more comets come in from the hemisphere from which the sun is moving.

The zones in the hemisphere towards which the sun is moving, and which has for its pole the direction of solar motion, have in general greater perihelion distances than the corresponding zones in the other hemisphere; the tendency being best exhibited as we go from the equator of the system.

As the sun moves on, the comets at great distances would come into the system, eventually, behind the quarter in which they first yielded to the attraction. Under the same general conditions, those which have come from behind the sun, and have been, as it were, dragged in its train, would pass nearest to the point of attraction when overtaking it.

These are the suggestions which most naturally occur. A complete discussion of the effect of the solar motion upon the distribution of comet-origins can hardly receive any decided confirmation with the amount of material that is likely to be available for generations to come.

R. H. TUCKER, Jun.

Lehigh university.

VOLCANIC SAND WHICH FELL AT UNALASHKA, ALASKA, OCT. 20, 1883, AND SOME CONSIDERATIONS CONCERNING ITS COMPOSITION.

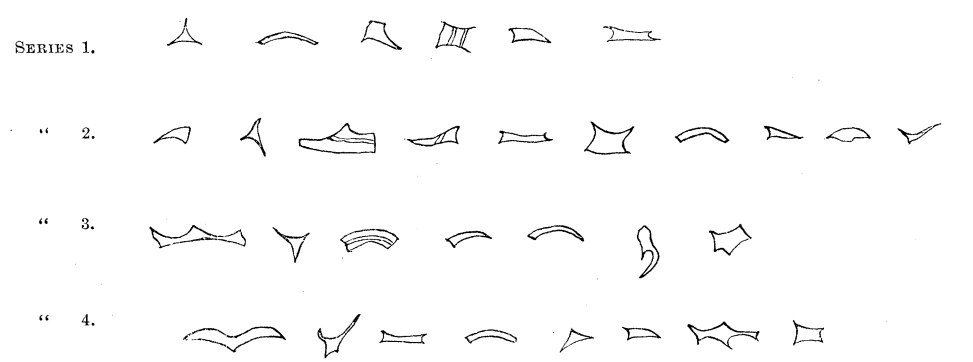
MR. APPLEGATE, the signal-service observer at Unalashka, reports that on the 20th of

October, 1883, about 2.30 P.M., the air became suddenly darkened, like night; and soon after, a shower of mixed sand and water fell for about ten minutes, covering the ground with a thin layer. The windows were so coated that it was impossible to see through them. A small portion of the sand was referred to me for microscopical examination; and, at this time of general concern in atmospheric dusts, it may be well to note the products of one of the Alaskan craters, which for some time has been in a state of more or less vigorous activity.

The sand is composed chiefly of crystalline fragments, of which felspar is the most abundant. It generally occurs in irregular, angular splinters, but not infrequently in well-preserved crystals with large inclusions and a distinct zonal structure. These crystals are slightly tabular, parallel to the clinopinacoid, and, lying on that plane, they present an approximately hexagonal outline, about 0.15 of a millimetre in diameter. Lath-shaped felspars, so abundant in basalts, were not observed. A few thin cleavage lamellae, with parallel extinction, showed no banding due to polysynthetic twinning; but by far the greater portion of the fragments, in polarized light, were distinctly striated. The pale green augite appears usually in the form of broken prisms; and the deep brown, strongly pleochroitic hornblende, which is less abundant than either the augite or felspar, occurs for the most part in cleavage plates. Irregular grains and crystals of magnetite complete the list of minerals which form an essential part of the sand. Crystal fragments of the minerals already mentioned constitute the largest portion of the sand; but, besides these simple grains, there are others complex in their nature. They correspond to the groundmass of a porphyritic rock, and are composed of an amorphous base, containing a multitude of microlites. Very rarely particles of clear volcanic glass may be found, and they are generally freighted with grains of magnetite. The grains of sand are fresh, and it is undoubtedly of recent volcanic origin. Its mineralogical composition is that of a hornblende andesite. Mr. Chatard of the U. S. geological survey, who made a partial analysis of the sand, found 52.48 % of silica, — an amount which is certainly much below the average for hornblende andesite. This paucity in silica, as well as in glassy particles, may be readily comprehended by considering the origin, composition, and distribution of volcanic sand and dust.

Among the various sands and dusts examined and compared for the purpose of seeking an explanation for the poverty of silica in the sand from Unalashka, is one collected about a dozen miles north-east of Mount Shasta, in northern California. This sand is considerably coarser than that from Unalashka, and is composed chiefly of crystal fragments of felspar, augite, hypersthene, hornblende, and magnetite, with particles of microlitic groundmass, and considerable pumiceous glass. The mineralogical composition of the sand is the same as that of the hornblende andesite which issued from the prominent and well-preserved crater named, by Capt. Dutton, Shastina, upon the north-western flank of Mount Shasta. There can be no doubt that the sand was ejected from Shastina, for all the other craters of that region have erupted different material. Mount Shasta itself has effused hypersthene andesite, and the smaller craters to the eastward have furnished basalt. According to Mr. Chatard's analyses, the sand contains 60.92 % of silica, while the Shastina lava, to which it belongs, contains 64.10 % of silica.

As far as definite observations upon this subject have been made, it appears to be true,



in general, that volcanic *sand* is composed chiefly of crystalline fragments, and contains a lower percentage of silica than the lava to which it belongs. With volcanic *dust*, however, the case is very different. That which fell in Scandinavia, March 29 and 30, 1875, after having been carried by the wind from the great eruption in Iceland a distance of at least seven hundred and fifty miles, was composed almost exclusively of irregular, angular particles of volcanic glass. Through the kindness of Professor Rosenbusch, in Heidelberg, I have obtained various samples of volcanic dusts for comparison. In the accompanying figures, series 1 represents the acute, angular, curved-sided fragments which are common in the Norwegian dust. In an excellent article by Murray and Renard, which appeared in *Nature*, April 17, 1884, p. 585, the forms of vitreous particles of Krakatoa dust are represented. It is undoubtedly true that the shapes represented are those which prevail in volcanic dust, but they appear to be less characteristic than the curious outlines of fragments from the same dust given in series 2. In the succeeding series (3) are outlined the less common fragments in rhyolitic dust, collected by Mr. I. C. Russell along the Truckee River, in western Nevada. That these acute, angular, curved-sided forms are the most characteristic ones of volcanic glass particles, is impressed by a study of old tufas, in which the glass, originally mixed with other clastic material, is completely replaced by quartz. An interesting tufa of this kind occurs at Breakheart Hill, Saugus, north of Boston. Where vitreous fragments of the most common shapes are replaced by another material, the pseudomorph does not always suggest the original constituent; but when we find such forms as are represented in series 4, from the Breakheart-Hill tufa, there can be but little question as to the original presence of volcanic glass.

Krakatoa dust which fell at Batavia has been analyzed by Mr. Renard, and found to contain 65.04 % of silica, while the pumiceous form of the same lava, according to Mr. Iddings, contains only 62 % of silica. It is well known that volcanic dust is composed chiefly and essentially of minute particles of natural glass; and, so far as definite observations have been made, they warrant the general assertion, that with occasional exceptions, which can be readily explained, volcanic dust contains a higher percentage of silica than the lava to which it belongs.

Volcanic sand and dust must be regarded as differing, not merely in the size of their particles, but also in their physical and chemical constitution; sand being composed, in the main, of crystalline fragments, and containing less silica than its corresponding lava, while volcanic dust is made up chiefly of glassy particles, which have a higher percentage of silica than the magma from which they were derived. Between these two extremes there are, of course, all possible intermediate terms; but, nevertheless, it is evident, that, as a result of the operation of natural causes, there is a decided tendency, in connection with violent eruptions, to separate the magma into a basic and an acidic portion. The degree of separation ultimately attained depends upon the final influence of the atmosphere upon their distribution. Under favorable conditions, the dust may be spread many hundreds of miles from its source, while the sand is scattered within a comparatively small radius; but, under less violent and favorable conditions, both may be precipitated near the crater from which they issued.

The inception of this divisional process is to be found in the condition of the magma before its eruption. It is well known that crystals are frequently, and sometimes abundantly, developed in a magma; so that, before its extrusion, the magma may be regarded as made up of a crystalline, solid portion, and an amorphous, more or less fluent portion. These are generally thoroughly intermingled, but occasionally they are arranged, as in obsidians, in alternating bands; and they differ from each other in several important particulars, besides those already mentioned. The earliest products of crystallization are basic minerals, such as the ores of iron, hornblende, and mica; and, as the process continues, the amorphous portion of the magma becomes more and more siliceous. On this account, the crystalline portion of the magma does not contain as high a percentage of silica as that which is amorphous. Capt. Dutton, in his researches upon the volcanoes of the Hawaiian Islands, made the interesting observation, that, at the moment a magma solidifies, a large quantity of vapor of water is given off. In the process of crystallization, the gases absorbed in the magma are rejected from the crystallizing substances, and accumulate, under enormous tension, in that portion which is amorphous. In this manner, the non-crystalline portion of the magma becomes stored with explosive compounds, under such stress, that, when the pressure is relieved, they may blow it to fine siliceous glass-dust; while the crystalline, solid, basic portion of the magma, pulverized rather

by external than internal forces, is reduced to sand.

It is doubtless true that a part of the volcanic sand and dust results from the trituration of solid material in the process of violent eruption; but, at the same time, it is generally believed that by far the largest portion of the latter is produced directly by the distention and explosion of multitudinous vesicles in the amorphous, viscous portion of the magma, and is the extreme product of the same operation which produces pumice. Mr. I. C. Russell has recently described some interesting volcanic dust from the Great Basin of Nevada. It has been traced two hundred miles from its source, the Mono craters, and has about the same chemical composition as the glassy lava of that place. This can be readily understood when we consider, that, at the time of its eruption, the magma contained few, if any, well-developed crystals. The difference in chemical composition between volcanic sand or dust, and the lava to which it belongs, appears to be directly proportional to the amount of crystallization which has taken place in the magma before its effusion. The composition of the Unalashka sand is such as to indicate that before its eruption there were many crystals secreted in the magma, so that there would be a proportionally small amount of siliceous dust produced. While it is evident that the constitution of volcanic sand is very variable from place to place, yet it is such in this case as to clearly indicate that it came from a crater erupting hornblende andesite, and that its basic character may be explained by supposing that the siliceous portion of the magma was carried away in the form of dust. The unaltered condition of the minerals and groundmass indicates that the sand has not been exposed to atmospheric influences for any considerable length of time, and favors the opinion of Mr. Applegate, that the sand came from the new crater, near the Island of Bogosloff, about sixty miles to the westward.

The precipitation of volcanic dust has been reported from several places in the United States, but it is all of very questionable determination. Mr. G. P. Merrill, of the U. S. national museum, has recently investigated that which fell at Rome, N.Y., and proved it to be an ordinary dust, composed chiefly of minute fragments of quartz and iron-stained products of decomposition. All of the reported dusts, of which I have been able to obtain samples, have been found to be like that which is most common about dusty cities and plains. A little experience will readily enable one to distinguish the Pélé's-hair and glass globules, in the dust of blast-furnaces and other iron-works, from the glass particles in volcanic dust.

The origin and distribution of the uncommon forms of dust are beginning to receive the attention they deserve; and it is a matter of gratulation, that the signal-service of this country has already taken steps towards systematic observations upon this subject at several elevated stations, such as Mount Washington and Pike's Peak, as well as in Alaska.

U. S. geological survey. J. S. DILLER.

METEOROLOGICAL CHARTS OF THE NORTH ATLANTIC.

ONE cannot fail, in studying the progress of maritime meteorology, to be impressed with the value placed on the Maury charts, as evinced by the frequency with which they have been copied, or have served as the basis for more extended work in foreign countries. But it is also to be noticed, that in recent years the tendency has been towards more originality and independence in the work of the several nations that take part in this branch of physical investigation; and, further, that while Maury's principle of exhibiting as far as possible the separate observations on which averages are based is retained, his plan of dividing charts according to topics has been replaced by the much more practical division according to time. The master of a vessel, beginning a voyage in May, does not care to find on his chart information about the winds of all the year, but prefers information of all kinds about May, and especially about the winds, calms, gales, squalls, and fogs of that month.

Having considered, in a previous article, the development of maritime meteorology as shown in the wind-charts of the North Atlantic, published by various foreign governments since Maury's time, it is with satisfaction that we can now turn to a work on the Atlantic, executed in our own country, in which the advance from the earlier styles of charting is as well marked as in any of the examples given above.

On the charts whose title is given in the note,[1] we find the atmospheric conditions over a large area shown with greater detail, and based on a larger series of observations, than in any other charts yet published. The number of observations is extraordinary. The chart for March alone has wind-observations for 211,057 hours. That part of the chart which corresponds to the six of Toynbee's ten-degree squares north of the equator has 63,846 hours: the

[1] Meteorological charts of the North Atlantic Ocean for the months of March, April, and May. Published June, 1883, at the hydrographic office, Washington, D. C. J. C. P. Dekraft, commodore, U.S.N., hydrographer to the bureau of navigation. Prepared under the supervision of Lieut. JOHN H. MOORE, U.S.N. Charts for June and July were published in March and April, 1884. T. R. Bartlett, commander, U.S.N., hydrographer.

same area in Toynbee's monograph has for March only 6,823 wind-observations. One of the five-degree squares (No. 676, latitude 0° to 5°, longitude 20° to 25°) into which the ocean is divided on our charts has 10,329 hours of record : this is practically equivalent to a continuous hourly record in this square for nearly fourteen Marches. If the other months maintain the same number of North Atlantic observations,

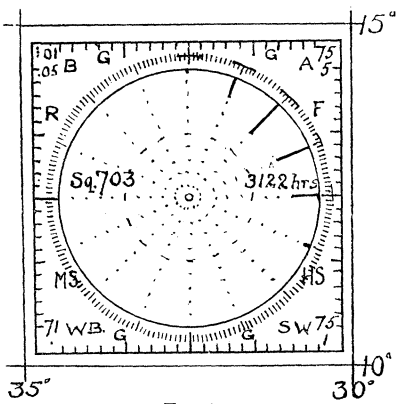


FIG. 1.

the year's average would be based on about 2,500,000 hours of record. On the other hand, many coast squares, and most of those off Newfoundland and Labrador, have insufficient observations. The wind-observations in this vast quantity of material come from the Maury records and from more recent logs in about equal number, but the data on the side of the squares rest on the recent logs alone.

Chief attention is given to classifying the wind in direction and force, as this is the factor of greatest use to the practical seaman. The percentage of the number of observation-hours during which the wind is recorded as having blown from every two points of the compass is shown by the fractional radius drawn inward from the appropriate part of the circle within the square. The average force for every wind-direction, in units of the U. S. navy (= Beaufort) wind-scale, is measured by the number of divisions, outside the circle (fig. 1), connected by a cross-line. The percentage of calms and variable winds is shown on the radial percentage scale by a ring and a cross at the centre of the circle. North-west and north-east gales (*G*) are shown in percentages on the top of the square; south-west and south-east, at the bottom. Moderate squalls (*M S*) and heavy squalls (*H S*) are placed on the lower half of the left and right sides of the square, rain (*R*) and fog (*F*) being above them. All these are given in percentages of their total hours,[1] and consequently, when taken together, give to the navigator a very close measure of the kind of weather he may expect for any part of the North Atlantic south of 50° latitude. The figures in the corners of the squares record the average stand and the average daily variation of the barometer (*B*), air-thermometer (*A*), wet-bulb thermometer (*W B*), and sea-thermometer (*S W*), thus completing the list of the more important and practically useful climatic elements. The most serious omission is the number of observations on which these side data depend.

The mechanical execution of the work is excellent. The charts, twenty-seven by thirty-four inches, are clearly and sharply engraved. The figures are, perhaps, rather fine, being smaller than in the accompanying cut, which does not fairly represent the clearness of the original, but they are not so fine as some in Toynbee's work; and some of the lines are too delicate for rapid reading, but they are perfectly distinct on a closer examination. Some ease of counting might be gained by emphasizing the fifty-per-cent divisions, as here marked. In comparing the graphic method of these new charts with the numerical and verbal form of record in the volume for the North Pacific,[1] issued by the hydrographic office a few years ago, it is difficult to make a choice, except as a matter of preference. The results shown are about the same in both. On the Pacific charts, from which a five-degree square is given in fig. 2, the number of observations, and average force of the wind for every two points, are given in the outer circle: the percentage that these observations make, of the total of winds, calms, and variables, is in the inner circle. The other data explain themselves. In the centre there is a verbal description of the characteristic local weather, for which there is no space in the Atlantic charts. But the frequency of gales from the four quadrants is not shown; and

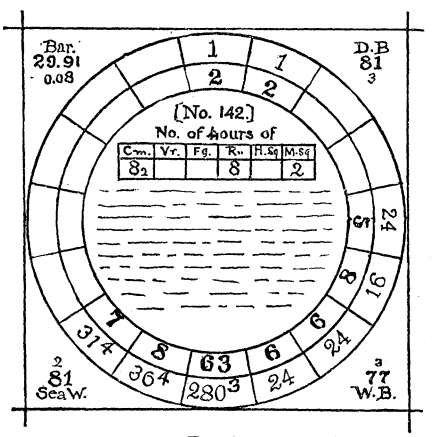


FIG. 2.

in making a comparison of winds from square to square, or even within a single square, the numbers have first to be read, and then compared; which is certainly more difficult than when the wind percentages and strengths are expressed in lines, whose

[1] The legend on the charts states that these side data rest on a smaller number of hours than is recorded for the general wind-observations.

[1] Meteorological charts of the North Pacific Ocean from the equator to latitude 45° north, and from the American coast to the 180th meridian. Washington, 1878. (Prepared under the direction of Lieut. T. A. Lyons.)

relative length is quickly seized by the eye. When the subdivisions go down to one-degree squares, then tabulation is necessary to save space, if a variety of data is to be shown; but, on five-degree squares, we believe the general preference would be for graphic representation, unless, what would be still better, both methods were combined, somewhat as in Toynbee's charts; but this would increase the size of the sheets. After all, the choice between the two methods must be made, not so much by the reviewer, as by the practical seaman, for whom the charts are especially constructed.

Currents are not attempted on these charts: it is the intention of the hydrographic office to give them special study as soon as possible, with particular attention to the temporary and local winds at the time of every observation. It may thus be possible to explain the rather discordant results shown on many current-charts. Before this, however, it is the desire of the office to complete the meteorological charts for the other oceans, on the plan now so well carried out for the North Atlantic. All who are interested in the success of this long piece of work will join in the wish that every aid and opportunity may be given to its progress.

The accompanying figure (fig. 3) is inserted for comparison of these new charts with those of Toynbee's squares that they cover, for the month of March. The full lines are isobars, the fainter ones being Toynbee's. Their agreement in general attitude is good, but there appears to be a persistent difference of reading of one or two hundredths of an inch between the two. The broken and dotted lines are sea-water isotherms, with satisfactory coincidence. The arrows show the average winds: the only notable divergences are in the region of variables and calms. On attempting to draw out the isobars for the whole of our March chart, smooth curves can be traced up to latitude 30° or 35° by admitting corrections of two or three hundredths of an inch. Farther north, where observations are fewer, and barometric variations are known to be greater, corrections of five-hundredths or more are sometimes needed. This is probably due to the great difficulty of finding closely checked barometer records, especially in the older logs. Although all defective records have been thrown out whenever detected, it is evident that some still remain; as, for example, in square 786, on the March sheet. We may therefore infer that the next improvement in the study of oceanic meteorology will come rather through increased accuracy than through increased number of observations.

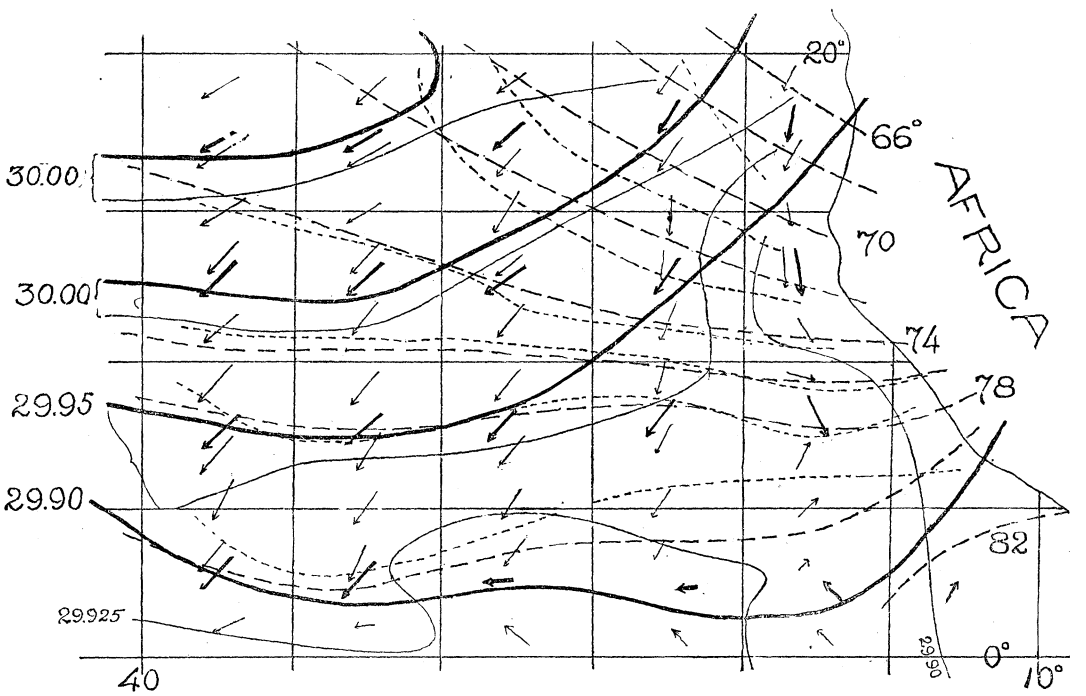


Fig. 3.

Another style of work undertaken by the hydrographic office is seen in the monthly Pilot charts of the North Atlantic, begun last December, of which mention has already been made in the columns of *Science*. These are designed to answer a double purpose, — first, to give a general representation of the prevailing winds for every month, based on the materials from which the more detailed meteorological charts above described are constructed; and, second, to serve as a ready means of publishing the

PILOT CHART OF THE NORTH ATLANT

NOTICES ISSUED DURING THE MONTH OF APRIL, 1884.

All bearings are true, and, in the case of lights, from seaward.

NOTICES TO MARINERS.

114 refers to the geographical position of Namorik (Barlag) island, of the Marshall group.

115 refers to shoals, &c., on the west coast of Madagascar

116. England—E. coast.—1. A green buoy marked WRECK lies in 12 fathoms at low water, 30 yards to the eastward of a sunken wreck off Cromer.

2. A spherical buoy, painted red and white in horizontal bands, and surmounted by a stan and triangle, has been substituted for the present NW. Shingles buoy, on Alexandra channel, Thames river entrance. The W Shingles, Shingles Elbow, SW. Shingles, and S. Shingles buoys have been altered from red can to red conical buoys.

117. Norway.—A rock, with seven feet of water over it, (marked by staff) lies near the fairway of approach to Donnaso from the southward. Position: *Lat.*, 65° 45′ 30″ N.; *Long.*, 13° 12′ 30″ E.

118. England—Bristol channel.—On or about February 15, 1884, the illuminated arc of the light at Ilfderol (or Braunton) low light-house was extended so that it will show one point more to eastward and three points more to westward. The full intensity of the light will show between the bearings N. 70° 15′ E. and S. 50° 00′ E. Variation 19° 15′ W

119. England—Isle of Man.—1. A length of about 600 feet of the outer end of the breakwater at port Erin has been partially destroyed by the sea, and is covered at high water ordinary spring tides. Mariners are therefore cautioned to keep well on the northern side of the bay. The light on the extremity of the breakwater has been discontinued until further notice.

120. Ireland—Baily nakill harbor.—1. Two small beacon buoys have been placed in the channel approaching Ross point. Black rock kept midway between these buoys bearing N. 9° E. leads to the anchorage off Ross point Variation 14° 30′ W.

2. Blige bar.—Two large triangular-shaped beacons have been erected on Lower Rosses point. Kept in line bearing N. 79° E. they lead over the bar in deepest water. Variation 23° 30′ W.

121. West Indies—Jamaica.—A beacon, about 20 feet above high water, consisting of an iron tripod surmounted by a cap colored red and white in horizontal bands, has been placed on the NE. part of Alligator reef, S. coast of Jamaica.

122 gives information concerning localities in Magellan straits and on the W. coast of S. America.

123 refers to the time-signal at Colombo, Ceylon.

124 gives information concerning shoals, &c., in the Java and Celebes seas.

125 contains general information concerning the coasts of Corea and the Loo Choo islands.

126. British Guiana—Demerara.—The buoy marking the wreck of the *Sea Curlew* has been removed. Pilotage is compulsory, but small vessels of 35 tons and under, from the neighboring colonies, and vessels coming to try the market without making an entry, unencumbered unless they take a pilot.

Curaçoa—Santa Ana harbor.—A *white* mooring buoy has been placed at the entrance, close off the SW. angle of Fort Amsterdam, on the eastern side of the channel.

127 refers to lights on Patim Island, in the Red sea.

128 refers to buoys, beacons, &c., on the coasts of Greece and Asia Minor.

129. England—Yarmouth.—1. A *green* buoy, marked WRECK, lies in eight fathoms at low water spring tides, 30 yards eastward of the brig *Sovereign*, sunk in Yarmouth road

2. **Thames river.**—Two *green* buoys, marked WRECK, are moored in 4¼ fathoms at low water spring tides, 40 yards to E½S and S½W of the steamer Alexandra Castle, sunk in Knob channel. A wreck marking light-vessel has been placed 140 yards S. 78° W. from the wreck. The light-vessel should be passed on that side on which two balls or two lights are shown. Variation 17° W.

130. West Indies—Cuba.—1. The light at San tiago de Cuba has been plainly seen, on two occasions, when 21 miles distant. Its period or revolution, frequently noted, is about 30 seconds, the period of greatest brilliancy being about 12 seconds.

2. The Diamante reef buoy, the Gorda bank buoy and the Gorda point beacon have all disappeared.

3. Jamaica—Port Royal.—The buoy on New Shoal is conical, white, with a horizontal red band,

131 refers to dredging operations at Leghorn and Civita Vecchia, Italy.

132 refers to reefs, &c., at Angra Pequena, W. coast of Africa.

133 refers to a light and a shoal in Sunda straits.

134 refers to a light on Pulo Rodjo, W. coast of Sumatra.

135 refers to lights, &c., in the Indian Archipelago.

136 refers to beacons in Wide bay, Australia.

137. United States—Vineyard Sound.—Several dangerous shoals exist in Monomoy passage between Shovelful and Pollock Rip light-vessels. They consist of patches with a least depth of 18½ feet near the northern extremity, and form an extension of Stone Horse shoal, in a northerly direction, to the 18 feet spot shown on Coast Survey chart No. 34, N. 70° E., ¼ mile from Shovelful light vessel. The patch, on a line between the two light vessels, has a least depth of 16 feet. Vessels of deep draught should keep to westward of a line joining the Handkerchief and Shovelful light vessels until on a line between the southern extremity of Monomoy point and Pollock Rip light-vessel.

138. United States—New Jersey.—On or about May 10, 1884, light-ship No. 44, moored on NE. end of Five Fathom bank, will be removed for repairs, and the RELIEF light-ship No. 24 will be substituted. The fog-signal while No. 24 is on this station will be a bell and a horn. No. 44 will be replaced as soon as the repairs are completed.

139 refers to a light in Frazier river, British Columbia.

140 refers to buoys, light-vessels, &c., on the China coast.

141 refers to a shoal off the coast of Chile.

142 refers to lights on the south coast of Australia.

143 refers to a light at Kobe, Japan.

144. France—N. Coast—Languess.—1. A wreck, with the stump of the lower mast and the jib-boom protruding from the water lies in 6¼ fathoms 1670 yards S. 22° E. from Essarts buoy. Variation 21° 30′ W.

2. **Dunkerque.**—A wreck lies near Dunkerque on the following bearings: Dunkerque light-house, S by E. Ruytingen light-ship, S. ¼ W. Variation 16° 30′ W.

145 refers to a light in Kalmar sound, Baltic sea.

146 refers to light and buoys on the coast of Austro-Hungary

147. Ireland—Copeland Islands.—About October 1, 1884, a flashing light, consisting of a group of four flashes at intervals of one minute, will be exhibited on Mew island, half a mile eastward of Copeland light-house island. During thick or foggy weather a fog-siren will give two blasts in quick succession at intervals of one minute. When this light is exhibited the light and fog bell at Copeland island will be discontinued

148 refers to a light at Mango, Spain.

149 refers to the time-ball at Cape Town.

150. United States—New York.—1. The spar buoys marking the various channels in the lower bay during the winter, have been taken up and the proper can and sun-buoys have been replaced.

2. **New Jersey.**—The wreck of the schooner Mary Matheson having disappeared, the wreck buoy has been removed.

151. United States—New Jersey.—A sunken wreck with the topmast about 40 feet out of water lies off the coast of New Jersey, with Tucker island light-house bearing N 78° W., ¼ W, 1¼ miles. Variation 6° 15′ W.

152. United States—Virginia.—A bell-buoy has been moored near red buoy No. 2, off the SE. end of the middle ground, entrance to Chesapeake bay.

153. West Indies—Orchilla Island.—A rock with 15½ feet of water over it lies in the entrance to Orchilla harbor, with the north point of NE. key bearing S. 83° 30′ E., and the outside line of breakers, which extend to the northward ¼ of a mile from Storm key, bearing S. 67° 30′ W Variation 3° E.

154 refers to beacons in Kirpon harbor, N. coast of Newfoundland.

155. Cape de Verde Islands—Porto Praya.—A shoal with depths of from six to seven fathoms lies to SSE'd of the city on the line joining the two points of Porto Praya

156. France—Turbot.—A second *fixed white* light has been exhibited from an iron standard erected 40 yards S. 58° W., from the old light at Turbot, Croisic roads. The two in line indicate the entrance Variation 19° W

157 refers to the withdrawal of wreck light-vessel at the entrance to the Belts, Denmark.

158 refers to reef in the vicinity of Falkland islands.

159 refers to a change in Pulo petri light, bay of Bengal.

160 refers to lights, &c., in the Mediterranean.

EXPLANATION.

100 Fathom Curve.

Lines of Magnetic Variation for 1884.

Information received during APRIL.

Storm Tracks.

Ice reported ..... Berg ▲ Field ▬

Wrecks ..... Flossing ; Rig and Position: ⊰ ⊱ Sunk: ⊰

Water Spouts.

Prevailing Winds and Currents for MAY.

Limits of Gulf Stream and other Ocean Currents.

Limits of Trades.

Direction and Force of Wind.

Light variable Winds.

Calms.

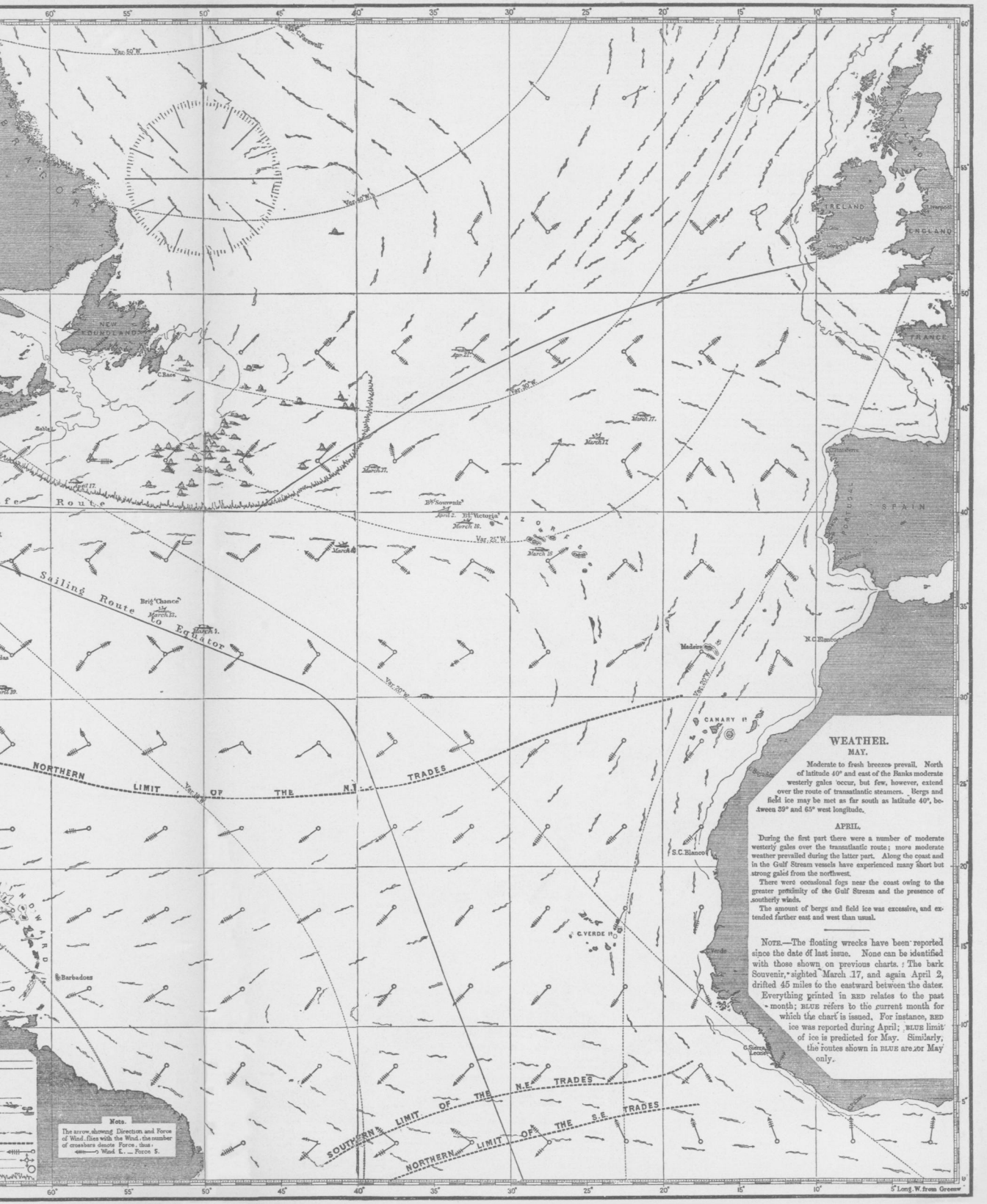
Limits of Ice.

Note.

The arrow showing Direction and Force of Wind, flies with the Wind: the number of crossbars denote Force, thus:
⟵ Wind E., Force 5.

Prepared by order of the Bureau of Navigation
Commander J.R.Bartlett, U.S.N,
Hydrographer.

U.S. Hydrographic Office, Bureau of Navigation, Navy Department,
Washington D.C.



U.S. Hydrographic Office, Bureau of Navigation, Navy Department, Washington D.C.

information concerning wrecks, ice, etc., gained during the preceding month. Through the kindness of Commander Bartlett, we are enabled to present a copy of the chart for May, reduced to two-fifths of the original, from a special print in black. As stated in the legend, every thing concerning the current month (in this case, May) is printed in blue in the regular issue; thus the direction and force of the winds are given, with the probable limits of the trades and of floating ice. On the May chart, the sailing-route to the equator, and the safe route to England, are added. On the other hand, information received concerning floating wrecks, ice, and notable storms or fogs, is printed in red. Only the geographic outline, the currents, and the permanent wording, appear in black on the original charts. The first four numbers, December to March, were accompanied by a few pages of letter-press, giving information concerning wrecks, storms, etc.; but it has later been found possible to present sufficient detail on the chart itself. Although the publication of these charts was duly authorized, no special appropriation was made for the collection of the information that they are designed to show. The co-operation of seafaring men, and those interested in the weather of the ocean, is therefore solicited. The distribution of the charts from the branches of the hydrographic office lately established in New York, Philadelphia, Baltimore, and Boston, as well as from the central office in Washington, will, doubtless, prove a strong incentive to a more complete reporting of the desired observation.

Having thus considered what has been already accomplished for the North Atlantic, we may give a few lines to studies now in progress in different parts of the world. Germany, England, and Holland have entered into a kind of co-operative agreement by which each party is to take charge of a relatively small part of certain oceans, and examine all the observations, furnished from all the parties, with the utmost detail; this plan being the outcome of several meteorological congresses. So far as I can learn, the German government, through Dr. Neumayer of the Deutsche seewarte at Hamburg, is at work on the North Atlantic between latitudes 20° and 50°, from shore to shore, the results to be tabulated in one-degree squares. About one-eighth of this work has been published.[1] The British meteorological council, of which Gen. R. Strachey is chairman, and Mr. R. H. Scott, secretary, has about completed a series of sea-surface temperature charts of the three great oceans for the cardinal months, February, May, August, and November, and have on hand a similar set of barometrical charts. A more original undertaking is the preparation of daily synoptic charts of the North Atlantic, in charge of Capt. H. Toynbee, for the thirteen months beginning Aug. 1, 1882, and ending Aug. 31, 1883; this being the period covered by the international circumpolar observations. It is estimated that there will be at least four hundred observations for each day; and from these it may at last be discovered what becomes of our Atlantic gales. The Indian meteorological service, in charge of Mr. H. F. Blanford, is studying the Indian Ocean north of the equator, lapping to the eastward over the area taken by the Dutch. The Dutch government, represented by Dr. Buys-Ballot of the Meteorological institute at Utrecht, has undertaken the investigation of the China seas (0°–30° north latitude, 100°–150° east longitude), but the results have not yet appeared. The former work of this office on the surface temperatures of the Atlantic, although of much importance, has, perforce, been omitted in this review; nor has there been space to consider various essays on ocean surface temperatures by Petermann, Cornelissen, and Koldeway, which might well be compared with the results on our hydrographic charts. The winds furnish material enough for examination in one essay.

It is surely fitting that our government should bear its share in these invaluable studies, and we trust the work now approaching completion for the North Atlantic may be speedily followed by similar studies of the rich material in our possession from the other oceans.

W. M. DAVIS.

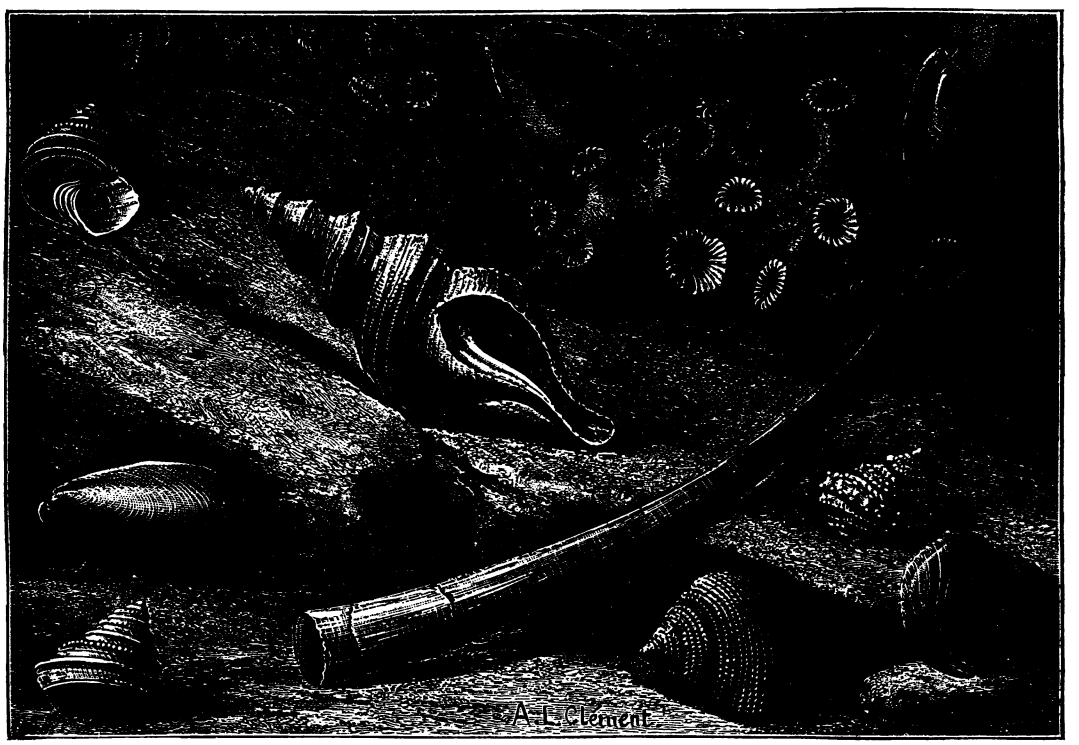
[1] *Deutsche seewarte. Resultate meteorologische beobachtungen von deutschen und holländischen schiffen für eingradfelder des nordatlantischen Oceans. (Quadraten* 146 *und* 147.) Hamburg, 1880, 1881. These include the area between 40° and 50° north latitude, and 10° to 30° west longitude.

INVERTEBRATES OF THE TALISMAN EXPEDITION.

IN a communication to the French academy, Dr. Paul Fischer observes, that, during the voyage, attention was directed especially to determining whether the deep-sea fauna of the tropical seas is peculiar to the geographical region, or derived by emigration from arctic seas. By dredging in a north and south direction in the eastern Atlantic, and comparing the results from different latitudes with those obtained by others in northern seas, it was hoped to arrive at a satisfactory solution of the problem. The line upon which work was done extended from the mouth of the Charente, over thirty degrees of latitude, to Senegal.

It is known that the superficial and abyssal faunae of the seas of tropical Africa differ greatly. The genera are not the same: their respective assemblages have no parallel relations. If the remains of these two contemporaneous faunae were fossilized, it might be supposed that they belonged to two different epochs, or represented the population of two uncommunicating seas. The abyssal fauna of the coasts of the Sahara, Senegal, and islands of Cape de Verde, contains a number of mollusks common to the arctic seas which have an immensely wide distribution. Such are Troschelia berniciensis, Chrysodomus islandicus, Scaphander puncto-striatus, Lima excavata, Malletia obtusa, Limopsis minuta, Syndosmya longicallis, Neaera arctica, N. cuspidata, Pecten vitreus, and P. septemradiatus. These range from Iceland and Finmark, or northern European seas, in comparatively shallow water, southward to various

points on the line, terminating at Senegal. A blind Fusus was dredged in over twenty-five hundred fathoms. These instances are sufficient to show the extension of arctic forms into tropical regions, but with these are found a great number of mollusks yet unknown in the North Atlantic. The abyssal fauna of the African coasts is therefore not composed solely of arctic immigrants. Lovén has shown that the arctic species range at greater depths as they advance southward, — a fact confirmed by other naturalists, and by the researches of the Talisman party. It is probable, therefore, that the idea now generally entertained by malacologists is correct, that the range of



DEEP-SEA MOLLUSKS LIVING AT A DEPTH OF FROM 1,500 TO 2,500 METRES. (Taken from *La Nature*.)
Calliostoma, Modiola, Fusus, Dentalium, Turbo, and Terebratula are represented.

these animals is determined by temperature rather than by the intensity of light or other factors. The investigations of the Talisman have considerably enlarged the number of Atlantic stations for mollusks reputed peculiar to the Mediterranean. Among these are Cassidaria tyrrhena, Umbrella mediterranea, Xenophora mediterranea, Carinaria mediterranea, Pyramidella minuscula, Pecten pes-felis, Spondylus Gussoni, and a number of others. Dr. Fischer concludes that the Mediterranean has very few peculiar species, and appears to have been populated in great part by colonists from the Atlantic, after the geological period in which communication with the Indian Ocean was cut off.

Lastly, the expedition obtained some of the remarkable forms first signalized by the U. S. fish-commission from deep water in the North Atlantic, among which may be mentioned Pholadomya arata, Mytilimeria flexuosa, etc.

W. H. Dall.

THE RELATION OF THE MOUND-BUILDERS TO THE HISTORIC INDIANS.

In *Kosmos*, vol. xiv., parts ii. and iii., will be found two papers, by Dr. Emil Schmidt, on the relation of the mound-builders to the modern Indians. The reputation of the author as a student of American aboriginal history will give to these papers great weight in Germany. It is important, therefore, in the interests of true science, to know what they contain, to indorse them where they are in harmony with the latest investigations, and to correct any mistakes into which the author may have fallen.

After paying a just compliment to the Peabody museum, the Smithsonian institution, and the Bureau of ethnology, and expressing his regret that the laity are still disposed to behold something wonderful and mystical in every thing that the mounds reveal, Dr. Schmidt passes in review the history of mound exploration for the last century. Capt. Hearne, in 1791, expressed the opinion that the earth-works could not have been the production of hunting Indians,

but of a sedentary people, under fixed laws and organized society.

Bishop Madison, in 1803, applied first to the works the titles 'sacred enclosures,' 'temple-mounds,' 'sacrificial mounds,' etc. Few of the successors of this writer — Atwater, Squier, Baldwin, etc. — have done any thing to lift the veil of mystery which encompasses the subject. Prehistoric America stands opposed, in their view, to the historic Indians: a cataclysm cut off the mound-builders, and the modern aborigines are a new revelation on our soil. In anatomy and culture they stood apart. They formed dense settlements in the Mississippi valley, organized despotic governments, worshipped the sun in holy places or on temple-mounds, and offered human sacrifices on their altars. They practised agriculture, handicrafts, and art extensively, amused themselves in well-ordered plazas, and buried their dead in mounds. Their time reached thousands of years back; their origin is unknown; they were driven from their homes by savages many centuries before Columbus. If any thing remains of their influence, it is to be sought in Mexico and Central America.

However unscientific much of the investigation has been, we have still material for the classification and comparative study of the mounds and earth-works. That the 'works' were designed for defence alone, Dr. Schmidt thinks there is no doubt; but they certainly tell us very little concerning the social organization of those who dwelt within them.

The author, speaking of the animal mounds, says they are usually of no specialized form, the particular animal typified in any case being unknown. There is nothing improbable in the suggestion that they are connected with the totemic system of all American aborigines. The truncated mounds, correlated by the older archeologists with the Mexican teocallis, were undoubtedly the sites of dwellings, acquiring their great dimensions in many instances by years of accretion.

The altar-mounds prove merely that here corpses were burnt, and with their ashes were deposited the things of greatest value to the dead. Surely there is nothing unique in this, since barbarous nations have done the same thing in all places and times. Let us, therefore, draw the pen through all the fables that have been written upon the civil and religious institutions of the mound-builders. Of the sepulchral mounds, Dr. Schmidt tells us that their variety and structure can be observed in the old world as well as in the new; and as for the fortification and signal mounds, they are generally only mounds of sepulture.

The geographical distribution of the various types points, not to one race, but to a variety of ethnic groups.

With respect to the art of the mound-builders, weaving, pottery, agriculture, metal-working, commerce, and war, there occurs nothing to differentiate them from the modern Indians. The attempts to connect them with Greeks, Etruscans, Phoenicians, or Hittites, through the 'inscribed tablets,' are not worthy of serious criticism. When we turn to the remains of the people themselves, the varied utterances of those who have studied the matter are a sufficient commentary upon their results. Indeed, the crania are so distorted that no conclusions can be reached; nor are the discussions upon the antiquity of the mounds of any greater value.

Dr. Schmidt's second paper is devoted to an examination of authorities to show, that, in each respect wherein the mound-builders have been deemed a unique people, modern or historic Indians have been found to equal or excel them. The author discusses systematically, for this purpose, agriculture, fortifications, buildings on the upper terraces, house-building, effigy-mounds, platform-mounds, deposits with the dead, cremation, stone-working, pottery, metal-working, ornamentation, textile fabrics, etc.

So much for the possibilities of the case. That the mound-builders were the immediate ancestors of any of our historic tribes must rest on language and tradition. In the Iroquois and Algonquin traditions, the author finds the necessary information concerning the commencement of that disaster which swept away the mound-builders, and, in the traditions of the Cherokees and Muskoki, the narrative of their extinction. We know their name, Allegéwi; in part, their language; we know their conflicts, and their last century of defeat and decline. The linguistic argument is based on the discussion of Indian migrations as evidenced by language, by Horatio Hale.

With the author's arguments, from traditional and linguistic grounds, for the identification of the mound-builders with the Allegéwi, many will have little sympathy. It is to the first part of the essay that especial attention is directed. On general principles, the continuities of human historic evolution are everywhere becoming even more apparent than those of the natural world. It is difficult to believe, therefore, that the erectors of the earth-remains of the Mississippi valley were a discrete people. The arguments of Dr. Schmidt are strengthened by the recent explorations and researches of Professor Cyrus Thomas in the mounds; of Mr. W. L. Holmes in the shell-carvings and textile work of their builders; and of Mr. H. W. Henshaw, the ornithologist, in the identification of the animals of the mound-pipes, etc. "It is certain," says Mr. Henshaw, "that, of the carvings from the mounds which can be identified, there are no representations of birds or animals not indigenous to the Mississippi valley. A large majority of the carvings are not exact likenesses either of animals or men. The state of art-culture has been greatly over-estimated." It is of the utmost importance to bear in mind, however, the fact, well authenticated, that the arts, complexity of social structure, and knowledge, of our modern Indians, have been greatly underrated. The probabilities of consanguinity between them and the mound-builders will be enhanced as well by placing the culture of the former on its true basis, as by an unjust depreciation of the works of the latter. O. T. MASON.

ENCKE'S COMET, AND THE RESISTING MEDIUM.

It is well known to those interested in the subject, that one of the very few cases in which the celestial motions are not perfectly represented by the law of gravitation is afforded by Encke's comet. Half a century has now elapsed since Encke announced that the comet, at each return, reached its perihelion two or three hours sooner than was expected. This lessening of the period was continually repeated at every return, thus showing the action of some continuous cause. He proposed the hypothesis of a resisting medium, or atmosphere, surrounding the sun, as affording the most plausible explanation of the fact. Encke having died in 1865, the subject was next taken up at the Pulkowa observatory by von Asten. The latter died in 1878; and, after some delay, the work was continued by Dr. O. Backlund, a young Swedish astronomer of brilliant reputation. His second memoir on the subject has just been published, and includes a minute discussion of the observations from 1871 to 1881, as well as a revision of some of Asten's work. The most important result which he reaches is, that the acceleration is still going on, but is only half as great as that found by Encke. One of the anomalous results reached by von Asten was, that during the two revolutions from 1865 to 1871 there was no acceleration. The revision of his work by Backlund shows, however, that this result was due to an error in some of the formulae which he used, and that, when this error is corrected, the effect is found to be continuous.

No new light has been thrown on the cause of this result. Astronomers have not generally considered the acceleration as a well-established fact; because the accurate computation of the perturbations produced by the planets, especially by Jupiter, is so intricate as to be very liable to small errors. The fact that Backlund has found an acceleration only half as great as that of Encke, shows that the method of the latter may be subject to doubt. At the same time, the amount of mathematical research which has been applied, and the constancy of the results found by all three investigators, now seem to leave little doubt of the fact. One reason for doubt has been that no other comet exhibited this retardation. This has been especially shown to be true of Faye's comet. But the difference in the two results may be fully explained by supposing that the atmosphere which resisted Encke's comet does not extend far beyond the orbit of Mercury, the fact being that Faye's comet does not even come within the earth's distance from the sun. There is no other comet on which the hypothesis can be tested.

The possibility that there is an exceedingly rare atmosphere around the sun is well worthy the attention of astronomers and physicists. The zodiacal light, the motion of the perihelion of Mercury, and the acceleration of Encke's comet, all point in this direction. The strongest evidence is afforded by the zodiacal light, because this shows that matter of some sort exists within the region referred to. But hitherto no means have been found to decide whether this matter is in a gaseous form, or in that of minute particles. In the latter case, the total mass would be too small to produce any effect upon the motion of either a planet or a comet. In the former case, however, we cannot assign any such limit. Researches into this subject under favorable conditions are greatly to be desired, especially observations upon the zodiacal light at some elevated point near the equator. As science becomes more extended, it is to be hoped that stations for observations will be selected with less regard to local considerations, and with more regard to the conditions of scientific success.

THOUAR AND CREVAUX.

The final report of Thouar, on his search for survivors of the Crevaux party, has been made public, and terminates the record of that gallant but unfortunately fruitless expedition to which reference has several times been made in these columns. By fruitless it is not intended to convey the idea that valuable results for geography and ethnology have not been attained by Thouar, but merely that the forlorn hope of rescuing alive any of Crevaux's party was disappointed.

After traversing with great haste the high plateau of Bolivia between La Paz and Oruro, experiencing a temperature of zero, Sucre, Tarija, and Caïza were successively reached. Conferences were had with all who seemed likely to afford information or advice; and letters written in French, Spanish, and the native dialect, were sent out among adjacent tribes. But even at this time there were no survivors. All that he could rescue was a broken barometer; a letter of Crevaux; a sketch-map of the Pilcomayo, prepared by Crevaux, and annotated by Billet; and a piece of one of the boats. On the 11th of September, 1883, he reached the spot where the massacre took place, where a photograph was taken, and two wooden crosses erected in memory of the victims.

The dead were cut in pieces by the Tobas, and each chief carried to his camp one of these ghastly trophies. The attack was prompted solely by a desire for vengeance. When Thouar inquired why they had killed Crevaux, who was so kindly disposed toward them, they invariably replied, "We killed your brother because those of your color have killed ours." The dead were dismembered on the very spot where, a few days before, several Tobas had been shot by some inhabitants of Caïza. Thouar hardly finds it in his heart to blame the Tobas, who had been wantonly assailed, and who know no distinction between white men. "The Toba," he says, "is strong, muscular, above the middle height. He has a dignified and impressive carriage. His color is that of old mahogany; his face is framed in long hair, black and straight; his forehead is narrow; the eyes slightly oblique; his cheeks prominent; his nose thick, broad, flattened at the tip; his mouth large. He occupies himself exclusively in fishing and hunting. His face, breast, and arms are ele-

gantly tattooed with charcoal made from cornstalks. In his ears are large cylinders of wood. He is rather idle, and does not cultivate the ground. His hands are so soft, that, if required to use an axe, he will blister them. The female Toba is strong, and of an agreeable aspect. Both are clothed in *ponchos*, with a breech-clout and sheepskin for warmth. They are much given to drinking a fermented liquor made from native grain, which is, however, denied to the women; and in each encampment there is always one Toba who does not drink, and whose business it is to preserve order and make up quarrels. They have several games with balls, etc., which they play for prizes, such as a sheep or horse. The women are very jealous of one another, and fight bitterly among themselves on the slightest occasion. Armed with sharp fish-bones, the combats, which the males regard with indifference, often end fatally. They believe in a good and in an evil spirit, and in ghosts of the dead."

Thouar had two hundred men put at his disposition by the Bolivian government, and with these undertook to traverse the Grand Chaco, and follow the course of the Pilcomayo. More than once he was obliged to give battle to hostile natives of various tribes, and, but for his Remington guns, might have been routed. The party was also annoyed by numerous jaguars, which prowled about the camp, and frequently stampeded the horses. The river is reported at that season to be fifty metres wide, but flowing between banks eighteen hundred metres apart, and twelve or fifteen metres high. The trees were like acacias, of delicate foliage, growing twenty or thirty feet high. On either side stretch immense plains covered with rich pasturage. Numerous large lakes were observed. On the 10th of November, pale, hungry, worn with fatigue, their clothing in rags, the party reached the Rio Paraguay and civilization.

The gallant explorer has been crowned by the academy, and has received the gold medal of the Société de géographie. It is probable that he will be enrolled in the Legion of honor, as a distinction fairly won.

W. H. D.

COUES'S BIOGEN.

Biogen: a speculation on the origin and nature of life. By ELLIOTT COUES. 2d ed. Boston, *Estes & Lauriat*, 1884. 66 p. 12°.

THIS little book contains a lecture on something to which the author gives the name that stands first on his titlepage. But the principal doctrine of the book, apart from the new thoughts to be suggested in its support by the author, needs no new name; being, as Professor Coues himself insists, nothing but the ancient doctrine that there is an immaterial basis for mental life, and that physical life itself is maintained by a peculiar 'force.' The author has previously privately printed his lecture, which was delivered to the Philosophical society at Washington; but the present edition is the first one actually published. In it the author adds a preface and an appendix. The discussion has plainly grown on his hands; and he expects to follow up this publication with other essays, since he now feels himself "in position to express himself more fully, freely, and explicitly on the subject" than he could do at first.

Not all of our author's readers will find it easy to take him very seriously, and for the benefit of such he has given in his preface a very entertaining collection of amusing things that have been said to him about the lecture since its delivery. Yet, if the little book will be diverting enough to many people, it is not to be regarded as merely a diversion: for Professor Coues has certainly enriched the ancient controversy with several new words, and with several misuses of old words; and the serious critic must accordingly look carefully to see whether this is all, and whether, in fact, philosophy has come out from under our author's pugnacious treatment with any addition save a swollen vocabulary.

It is in the appendix that Professor Coues undertakes to define the terms that are to be used in discussions about the nature of the soul of man. His definitions are of this sort: "A man's 'mind,'" he begins, "is not a *thing* in the ordinary sense of the word 'thing:' it is a relation between two things. These two things are his soul and his body."

But what, then, we ask, is the soul? "The soul," we learn, is a thing, "an actual entity, a living being of knowable and recognizable qualities, attributes, and potencies." "It consists of a kind of semi-material substance." This substance is "animalized astral fluid; that is to say, some quantity of the universal ether, modified by vital force." To this 'soul-stuff' the name 'biogen' is applied. It corresponds closely to the recently famous 'fourth state of matter.' It is the 'od' of Professor Reichenbach. It exists in all animals and plants while they live. This stuff helps the spirit to act upon matter. As for spirit, it is the immaterial element in the world. Soul and spirit are, therefore, not the same thing. Soul is 'semi-material:' spirit is not material at all. Spirit cannot act directly on matter: soul is the body of the spirit, and helps it to act on grosser matter. This semi-material soul persists after death, and is then all of a man that remains, besides his immortal spirit. Under earthly conditions, the gross material body is added, and interaction between this body and the spirit is made possible by the presence of the semi-material soul. The soul-

substance, or biogen, is the vital principle of the living man. Thus far, then, our author.

We are in no wise concerned, as yet, to test the truth of all this. We desire, for the first, only to examine the good sense of it. Our author suggests several interesting thoughts by his very original definitions. Mind is only a relation between soul and body, but not a thing. 'Mind,' also, 'is what the spirit thinks in consequence of its connection with matter.' 'Reason is the mistress of the mind.' 'Its exercise is judgment, or the critical faculty.' Hence, it seems, Professor Coues would define a judgment as "the exercise of the mistress of a relation that the spirit thinks, in consequence of its (the spirit's) connection with matter." This definition obviously expresses a very distinct advance in the clearness of philosophic thought, and ought to be useful in future logic textbooks. The materials for it are found on one page together. However, it is somewhat unfair to judge Professor Coues by any one page of his book, since he says various things on various pages; such as, that "mind [viz., the aforesaid 'relation'] is what the spirit retains when it becomes disembodied" (p. 61), and that "mind, as the expression of a relation between the soul and the body, necessarily disappears when that relation is discontinued" (p. 13). It follows from all this, that Professor Coues has been led to enrich philosophic language by a definition of mind of which he himself can make nothing, and of which we, of course, cannot hope to make much more.

But of mind, enough. Let us think of this *soul-stuff*. It is 'semi-material.' This may mean either of two things: it may mean that soul is made, half of it out of matter, and half of it out of something else; or that the soul is a sort of a something that is neither matter nor the opposite of matter, but halfway between the two. Which is our author's meaning? If we go from the appendix to the lecture, we find (p. 55) a definition of biogen, or soul-stuff, as "spirit in combination with the minimum of matter necessary to its manifestation." This would seem to answer our question. Biogen, or soul-stuff, is semi-material because it is spirit plus a minimum of matter. The same view is borne out by expressions in the appendix itself. But other expressions give countenance to the other view. The soul-stuff is the 'body of the spirit.' Its substance is the 'medium of communication between spirit and matter.' It is tenuous, elastic, and probably not atomic in structure. It flows about, it is sometimes projected from the living body during sleep, etc. In all these cases the *semi* in *semi-material* seems to refer, not to the composition of biogen as being matter plus spirit, but to its nature as being halfway between matter and spirit. Soul-stuff is thus expressly opposed both to spirit and to gross matter, being a sort of a something in between the two. One infers, from this confusion and self-contradiction, that Professor Coues has written his essay on biogen without ever knowing what he really means by the word, although it is all his own.

The relation of this biogen to 'vital force' is also a question which a careful reader anxiously considers. Biogen is not a force at all (p. 64), but a THING (the capitals are our author's). When acted upon by spirit, however, it is the 'vital principle;' and the 'vital principle,' as we learn from p. 63, is "simply the force by which the spirit acts upon matter through the medium of the soul." Hence, to sum it all up again, the soul-stuff, which is not a force, but a thing, becomes, nevertheless, when acted upon by the spirit, a force; viz., that force by which the spirit acts upon matter through the medium of this soul-stuff itself. This we must leave to the reader's ingenuity to unravel. We confess ourselves baffled.

Clear ideas about biogen the reader must therefore not expect. Professor Coues does not go to his philosophic studies for such cheap commodities, and nobody need demand such things from him in this field. He has simply amused himself a little by telling us about the well-known traditional views of many people, using a hopelessly muddled terminology of his own invention to express no more of the traditional view itself than many well-instructed children in religious schools can tell us. And they would understand their language quite as clearly as Professor Coues seems to understand his own. No apology, to be sure, would be needed, if Professor Coues had simply come forward to maintain in a plain manner so ancient and respectable a faith as that in the existence of immaterial forces and agents: but there is, at the same time, no reason why he should confuse our minds with new meanings, that are yet no meanings, given to words that we have long since learned to use somehow; and there is no need of new words, unless the inventor can give us some clear idea of what they are to mean. Therefore the value of our author's contribution to the discussion becomes forthwith obvious.

The lecture itself is devoted to proving the dogmas thus defined. But it is enough to say of the whole argument therein set forth, that our author seems entirely to forget one very

simple question which nowadays the plain man puts whenever he hears of such a discussion as this. The objection to 'vital force' and 'immaterial agents' in the plain man's mind is, that they are like the 'dormitive virtue' of opium. They are just x and y, used where all hypotheses of a more definite nature just now fail to do the required work; and they simply say that some conditions not now better known must be present to cause certain phenomena, such as those of life, or such as the phenomena of the human mind. They differ from x and y only in being less frank expressions of ignorance. They masquerade (so thinks our plain man) in the long-clothes of Latin or Greek terms; but they are none the better for that, and we are none the wiser. Now, Professor Coues altogether neglects, in his discussion, to set the plain man's mind at rest about this matter, so far as this objection would apply to his biogen. Apart from the wildest assumptions concerning the 'ether' or the 'astral fluid,' Professor Coues has nothing to say in favor of biogen, save that nobody can make living matter, and that nobody can explain the origin of our minds. Hence, he reasons, the soul is immortal, and biogen is a fact.

All this is of course tedious. We have long since abandoned such methods. Materialism, as a philosophic theory, is indeed untenable enough, and no intelligent student of philosophy in our day is apt to become an old-fashioned dogmatic materialist; but heaven knows, that, if such arguments as this of our author were our only refuge from materialism, we should all forthwith be either materialists or word-mongers.

Such thinkers as Professor Coues lets himself be joined with in this lecture, have no genuine conception of what a philosophic problem is. To them materialism is a doctrine to be combated by talking about the mysterious character of life, and the possibility of 'semi-material' substances. They do not see, that if the spiritual character of the world, and the supremacy of reason in it, are to be proved at all, they must be so proved as to make reason actually manifest in all parts of the world. If an atom or a brick-bat, however incomplete an expression of reason it may be, is not as truly an embodiment of the rational and spiritual reality that lies at the foundation of things as is the best-organized structure on the planet, then there is no truth at all in a spiritual theory of the world. Therefore let nobody fancy that he proves or disproves the world to be rational or spiritual by proving or disproving that there are one or two subtle fluids in it more or less than had been noticed before. If life result from an altogether unique natural 'force,' so be it. Prove and make plain the meaning of the fact, and we shall be as content with it as with any other natural truth. But that proof would not make life one atom more or less spiritually significant than it now is. The moral and the rational order of the universe would be in no wise more or less manifest; the fallacy of philosophic materialism would be no more or less evident; and, if we could make shiploads of Shakspeares in our laboratories to-day, the spiritual nature of things would be no less certain. Discussions that dwell with rapture on possible, vaguely defined, mysterious, 'semi-material' fluids and potencies, help us no nearer to the explanation or to the proof of the rational truth of things, and do help us to think less rationally ourselves.

There are, in fact, two forms of idealism prevalent amongst us. One we might call the mendicant form of idealism; since it is always begging the world of experience to show us something fantastic, romantic, intangible, unutterable, so that we may live in awe as at a juggler's show. To this view God is himself a sort of showman, who likes to hear our outbursts of wonder when he does odd things. Such idealists are never so sure of the spiritual truth of things as when somebody has just finished a ghost-story. Or, if they abandon this fashion of idealism, they devote themselves to inventing halfway substances, too fine to be seen or touched, too subtle to be reached by physical experiments of any sort, far less the objects of experience than is the universal ether an object of experience, and unlike the ether in having no definable properties. These they glory in. These are the earnest to them that our world is not commonplace nor gross, but the offspring of reason, the dwelling-place of God's power.

To such idealism Professor Coues seems willing to join himself. His idealism, it would seem, would be in some danger if we found how to produce live germs in our laboratories. He hints at mysterious stories of a supernatural character as indicating something about the nature of biogen. He seems to depend on the phenomena that are not yet explained, as the sole foundation for a spiritual theory of the world; and he seems, meanwhile, to suppose himself a kind of Elijah among those worshippers of Baal, the materialists. Only believers in the fantastic and indefinable can be idealists; and he is one of the few faithful.

But there is another form of idealism in the

world, and that idealism is indifferent to all this love of merely fantastic and romantic mystery. It regards the world as through and through rational, and for that very reason it does not suppose phenomena to be more divine, merely because of the accident that we cannot explain them by any general rules of experience. It insists, that if we could produce new life of any order, high or low, as easily as we can strike a light, life would be no more and no less a manifestation of the divine reason than it now is. And this idealism needs no subtle 'astral fluids' to convince it that there are spiritual realities. The true nature of a cow is not more manifest in skimmed and watered milk than it is in the rich new milk; and this trust in 'subtle media' is merely a demand that we shall believe only the skimmed milk of nature to be a genuine expression of the divine life. If all the matter in nature were for our senses composed of indivisible particles as big as paving-stones, and if every heap of these paving-stones, however and whenever made, behaved just like a rational being, and wrote philosophic lectures, the spiritual nature of reality would be just as manifest as it now is, and philosophic materialism would be just as absurd. Hence Professor Coues does what this second form of idealism regards as something worse than wasted labor. He not only talks confusedly about his unintelligible biogen, but he helps to disseminate the impression that a belief in a spiritual truth in the world depends upon a faith in the existence of some fluid so thin that you cannot say any thing definite about it. All this is rank paganism; for it is analogous to the views of those peoples whose gods are conceived after the fashion of smoke.

JOSIAH ROYCE.

REPORT OF THE OBSERVATORY AT HERÉNY, HUNGARY.

Publikationen des astrophysikalischen observatoriums zu Herény in Ungarn. Herausgegeben von EUGEN VON GOTHARD. Heft i. Herény, 1884. 104 p., 6 pl. 4°.

THE astro-physical observatory of Herény has recently issued its first volume of publications, prefaced by the director, von Gothard, with a graceful tribute to his friend, the well-known Dr. von Konkoly.

The observatory is situated on the estate of Herény, near Steinamanger, in the western part of Hungary. The main building was finished in 1881, and is of two stories, with a tower for the equatorial at one corner: a smaller building receives the transit instrument. The rooms are all admirably planned and arranged to promote the comfort and efficiency of the observers. In the upper story we find an office, a room for the director, and a large, well-appointed physical laboratory. On the ground-floor there are, besides two smaller rooms, a chemical laboratory fitted with many conveniences, and a workshop. The workshop, a feature in which most of our observatories are deficient, is supplied with tools intended not only for making minor repairs, but for constructing many valuable pieces of apparatus; and what is even more valuable, as it is unusual, the director and his assistants appear to be skilful mechanics.

The principal instrument of the observatory is a Newtonian reflector by Browning, of ten and one-fourth inches aperture, which is provided with a very complete outfit of photographic and spectroscopic accessories. A little portable transit of about an inch aperture, the object-glass of which is by Fraunhofer, and the mounting by Reichenbach, is used for determining time. There are two astronomical clocks by Freitag, a set of meteorological instruments, and a large collection of subsidiary physical apparatus. The library, though still small, is steadily increasing.

The director of the observatory, Eugen von Gothard, is assisted by his brothers, Alexander and Stefan von Gothard, and by Josef Molnar. The observations in the present volume are, for the most part, upon the spectra of the fixed stars. In 1881 and 1882 the spectra and colors of nearly three hundred fixed stars were examined, and the stars classified according to Vogel's types. Spectroscopic observations, and observations of a generally descriptive nature, were also made of Wells's comet, the great comet of 1882, and Barnard's comet. This, together with observations for time, and the care of the clocks, has been the director's work. Alexander von Gothard contributes the physical observations upon Jupiter and Mars, accompanied by twenty-four well-executed sketches. Miscellaneous observations include observations of the solar eclipse of May 16, 1882, and the August meteors of that year. Satisfactory observations of the transit of Venus were not obtained on account of unfavorable weather.

In the typography of the volume, and in the care and neatness with which the plates are prepared and bound, the young observatory will compare favorably with many older institutions.

INTELLIGENCE FROM AMERICAN SCIENTIFIC STATIONS.

GOVERNMENT ORGANIZATIONS.

Geological survey.

Work in California. — During March, rainy weather interfered very much with the field-work in the division of the Pacific. The study of the Knoxville region, however, was completed by Mr. Becker, who made two cross-sections of the area mapped, and finished his notes of the surface-geology.

Four sections were made of the Redington quicksilver-mine, and notes of others also taken. The first half of April was very stormy, rendering a camping-trip inexpedient. On the 1st of the month, however, Mr. Turner proceeded to Tres Pinos, to make observations on the granite reported to be in that neighborhood by Antisell and others. Between the first and the middle of the month, Mr. Turner occupied the intervals between the storms in making a reconnoissance of the region adjacent to Tres Pinos.

About the middle of April, Mr. Becker and a party, including Mr. Turner, proceeded from Tres Pinos to New Idria, making excursions on both sides of their route, and reaching New Idria the latter part of the month. Mr. Becker hopes to complete the New Idria district during May. He reports that the granite between San Francisco and New Idria, of which there is a considerable amount, is, so far as he has seen it, of one character, and does not differ from that of which the Farallone Islands are composed. It presents lithologically no evidence of recent origin, but has all the appearance of ancient granite. He reports, also, the existence of large areas of basalt at no great distance from Tres Pinos, and an important area of the same rock immediately south-west of Panoche valley. He says, also, that the most cursory study of the pebbles of the recent stream-beds, and the extensive gravel-deposits of the area passed through, renders it evident that there are other important areas of basalt. The same sources of information also prove that andesite eruptions must have taken place abundantly, although in his hasty trips he did not come across the rock *in situ*. He thinks that a thorough examination of the coast-ranges north of New Idria would show a considerable area of andesite. The sedimentary deposits noted were of three classes: 1°, highly metamorphosed and sometimes contorted beds, similar to those of the Clear Lake and Knoxville districts; 2°, lying unconformably upon the latter, considerably tilted, very slightly contorted, unaltered beds, mainly sandstones, exceedingly fossiliferous in places, and corresponding to Whitney's miocene; 3°, resting unconformably on these, again, uncompacted conglomerates, very slightly tilted, and, so far as examined, without fossils.

In the laboratory at San Francisco, Dr. Melville has been engaged in routine analyses.

Mr. Curtis has been in Washington for some time, revising proof of his monograph (No. 7) on the silver-bearing lead-deposits of Eureka, Nev., which is in press.

Mr. Hoffmann finished the corrections and additions to the topographic work at Clear Lake in April, and early in May reported at Washington, where he will map the work done by him in 1882 in northern California.

Miscellaneous. — Nearly all the rocks collected by Mr. J. S. Diller in the Cascade Range, in northern California, have now been identified; and the labelling and cataloguing of the collection, so far as thin sections of the rocks have been prepared, have been completed. The hypersthene andesites are found to be the most abundant. Members, also, of a new group of rocks have been found, which promise to be of especial interest. —— Mr. Vanhise, assistant to Prof. R. D. Irving, made, in March, seventy-two new thin sections of rocks; and descriptions were prepared of forty of that number. In April, Mr. Newman, at Washington, prepared eighty sections for Professor Irving, and also of a few rocks from the Cascade Range. —— Through the kindness of the superintendent of the Naval observatory, Capt. C. E. Dutton has begun a study of the moon's surface in connection with the study of the volcanic features on the earth. —— Mr. Diller has prepared about a dozen sections of fulgurite and its fusion-products, and is making a special study of them, with results of exceeding interest.

Engineers' school of application, Willets Point, N.Y.

Aurora borealis. — The regular series of records of the displays of the aurora borealis, begun in 1870, has been continued as heretofore. Three sentinel-posts, widely separated from each other, are guarded nightly by soldiers of the Battalion of engineers, specially selected as watchmen. Eight men are thus permanently detailed. Three of them remain on duty from sunset to sunrise, and are required to report, when relieved, whether they have seen any auroral light during the night, and, if not, whether the sky has been sufficiently clear to permit any to be visible. These records for the past year are presented in the following consolidated table, which,

AURORAL DISPLAYS IN 1883.

Name of month.	Auroras.				Clear nights.				Cloudy nights.			
	Post No. 1.	Post No. 2.	Post No. 3.	Mean.	Post No. 1.	Post No. 2.	Post No. 3.	Mean.	Post No. 1.	Post No. 2.	Post No. 3.	Mean.
January . . .	0	0	0	0.0	11	8	11	10.0	20	23	20	21.0
February . .	2	3	2	2.3	16	15	15	15.3	12	13	13	12.7
March . . .	4	4	2	3.3	22	23	21	22.0	9	8	10	9.0
April	3	3	2	2.7	16	15	15	15.3	14	15	15	14.7
May	0	0	1	0.3	17	16	17	16.7	14	15	14	14.3
June	1	1	1	1.0	16	17	18	17.0	14	13	12	13.0
July	5	6	5	5.3	22	22	21	21.7	9	9	10	9.3
August . . .	1	1	2	1.3	26	26	27	26.3	5	5	4	4.7
September . .	4	3	3	3.3	15	16	17	16.0	15	14	13	14.0
October . . .	2	3	2	2.3	20	18	17	18.3	11	13	14	12.7
November . .	2	2	2	2.0	17	19	20	18.7	13	11	10	11.3
December . .	0	1	0	0.3	19	17	17	17.7	12	14	14	13.3
Total for year.	24	27	22	24.1	217	212	216	215.0	148	153	149	150.0

considering the difficulty of distinguishing the fainter displays, is regarded as establishing the trustworthy character of the record by the general accordance between the three independent observers. It appears, that, out of 215 favorable nights, 24 auroras were noted; and, if we may assume the same ratio to apply to the cloudy nights, about 41 auroral displays occurred during the twelve months.

These observations were undertaken to throw light upon the supposed connection between the number of solar spots and the frequency of auroras and of magnetic disturbances. They have now been continued long enough to give interest to the following summary, compiled from the annual astronomical orders. It will be noted that there is a marked correspondence between the epochs of maximum and minimum auroras, and of maximum and minimum solar spots, as given by Prof. Fritz of Zurich; viz., —

Epoch of maximum solar spots	1870.6
" minimum " "	1878.9
" maximum " "	1882.4

The column headed 'Average number of sun-spots' is derived from the observations of Prof. D. P. Todd, published by the U. S. signal-office.

SUMMARY OF AURORAL RECORDS FOR FOURTEEN YEARS.

Year.	Clear sky.		Cloudy sky.		Total for year.	Average No. of sun-spots.	Remarks.
	Nights.	Observed auroras.	Nights.	Probable auroras.			
1870	184	50	150	41	99	–	11 mos.
1871	211	60	154	44	104	–	
1872	234	60	132	34	94	–	
1873	214	54	151	38	92	–	
1874	190	18	175	17	35	–	
1875	189	14	176	13	27	–	
1876	195	9	171	8	17	–	
1877	191	7	174	6	13	2.6	Began
1878	185	2	180	2	4	2.2	June,
1879	204	9	161	7	16	2.0	1877.
1880	216	13	150	9	22	14.3	
1881	191	23	174	21	44	26.7	
1882	201	55	164	44	99	28.3	
1883	215	24	150	17	41	27.4	

RECENT PROCEEDINGS OF SCIENTIFIC SOCIETIES.

Albany institute.

May 13. — Dr. James Hall gave a description of some forms of newly discovered fossil sponges of the family of Dictyospongidae. Fossil sponges begin in the paleozoic rocks, and continue upwards through the coal-measures. The divisions of the fossil sponges are by fours : that is, some had four marked longitudinal lines or ridges; others, eight, and twelve, and sixteen. The most remarkable form was one with thirty-two radiating lines connected by concentric rings resembling a spider's web. Of this there are only two specimens in the world, yet discovered; and these are in the New-York state museum. Until within a few years the fossil sponges had been undetermined, and many had regarded them as the remains of true vegetable forms of life. Europe, up to 1883, had produced but five species of fossil sponges of the family Dictyospongidae. From New-York state, Professor Hall has secured thirty-five species, thirty-one of which he has been the first to discover and to describe. A notice of the family Dictyospongidae was read at the meeting of the American association for the advancement of science, in Montreal in 1882, and plates from the thirty-fifth Report of the New-York state museum of natural history were exhibited. The paper at present in press gives descriptions of the genera Cyathophycus, Dictyophyton (= Hydnoceras Conr. 1842), Ectenodictya, Lyriodictya, Thamnodictya, Phragmodictya, Cleodictya, Physospongia, and Uphantaenia, with numerous illustrations.

Academy of natural sciences, Philadelphia.

May 6. — Professor Joseph Leidy directed attention to some little tape-worms which had recently been submitted to his examination. They were expelled, after the use of santonin, from a child of three years. The specimens, consisting of a dozen fragments, appear to be portions of three worms, which probably reached a length of from twelve to fifteen inches. Unfortunately the head is lost. The joints, or proglottides, are several times broader than long. The eggs occupy a simple uterus, defined by the walls of the joints, and not divided into pouches diverging laterally from the main stem, as in most Taeniae. A singular feature of the worm is the interruption of the series of ripe joints, here and there, by one or more completely sterile ones. The generative apertures open in the usual way on the lateral margin of one side. The mature eggs are spherical, measure 0.072 of a millimetre diameter, and contain fully developed, six-hooked embryos. While differing greatly from the ordinary tape-worms infesting man, they approximate nearly the description of Taenia flavopunctata, and probably pertain to this species. This has been but once previously observed, and was described in 1858 by Dr. Weinland, from specimens in the museum of the Medical improvement society of Boston. These also were discharged by a child. It is probable that the worm is more common than would be supposed from the instances of its observation, and has perhaps escaped notice from its small size, and from the general ignorance of the distinction, not only of this, but of the ordinary species of tape-worms. —— Prof. J. T. Rothrock referred to the structure of the common violet, and remarked that he had observed that in the flower, the so-called path-finders, or lines of the petals leading to the ovaries, are much more conspicuous on the lower and side petals than on the others, thus rendering them of most use to insects, which are supposed to be guided by them to the ovaries.

May 13. — Professor Joseph Leidy exhibited specimens of a curious parasite (Pentastomum proboscideum), found in the lung of a large rattlesnake (Crotalus adamanteus) from Florida. They are cylindrical, incurved, annulated, largest at the head, tapering behind, becoming again larger, and rounded at the end, and terminating ventrally in a short, conical point. They vary from nine lines to thirty-one lines in length, and from one and a half to three lines in width at the head. Although these curious creatures, in their mature stage, are cylindrical, worm-like, limbless bodies, they are allied, by their structure and embryonic peculiarities, to the Arachnida, or spiders. —— Mr. Edward Potts announced the discovery in Harvey's Lake, near Wilkesbarre, of vast colonies of a species of the beautiful polyp, Cristatella. He had not been able to determine whether or not it belongs to one of the three described species of the genus. They may prove to be distinct, although it is not improbable that all the species may hereafter be considered as one. The specimens were collected from the smooth, inclined surface of logs, and from the branches and twigs of submerged trees. Colonies had since been formed on the sides of a collecting-jar, each statoblast having developed into from three to eight polyps. The colonies are not circular, but have a persistent appendage which contains none of the polypiferous cells. Supposing the form to be new, he proposed for it the name Cristatella lacustris.

Colorado scientific society.

May 5. — Messrs. W. F. Hillebrand and Richard Pearce made a preliminary communication in regard to an interesting group of minerals recently found in Utah, some of them being new to the United States. The minerals found are, enargite and the secondary hydrous arseniates, olivenite, and conichalcite (Dana's System of min., p. 565), with two amorphous substances corresponding, apparently, to pitticite and chenevixite. The olivenite occurs in small, distinct crystals; the conichalcite, in form similar to that from the only locality previously known, in Spain, while its chemical composition is also very near to that of the original mineral, a small amount of copper being replaced by zinc. Jarosite, turgite, and one or two as yet undetermined species, occur sparingly with the above. Mr. Pearce also exhibited pseudo-malachite associated with hübnerite from near Phillipsburg, in Montana.

Society of arts of the Massachusetts institute of technology.

April 24. — Prof. Charles R. Cross gave a lecture on 'The determination, history, and present standards of musical pitch.' After referring to the use of the sonometer for determining the relative number of vibrations of any two notes, Professor Cross gave a description of the methods of determining the absolute number of vibrations of any fork, giving an account of König's researches (*Amer. journ. otology*, October, 1880), and explaining the use of Scheibler's tonometer. The only good standard was stated to be the tuning-fork, which varies its rate less than $\frac{1}{9000}$ per degree (Centigrade) of change in temperature; while the organ-pipe and the oboe, sometimes used as standards, vary much more with changes of temperature. The history of pitch was discussed, and tables given showing the change in the standards from time to time. The principal change had been a gradual rise of the standard. Some measurements made by Professor Cross in 1880 had given results, of which the following is an abstract: —

	Number of vibrations, C_3.
Ritchie, copy of Chickering's standard	269
Mason & Hamlin, French pitch	259.1
Hook & Hastings, old flat organ-pitch	264.6
Organ in Church of Immaculate Conception, Boston	266.7
Chickering's standard fork	268.5
Smith American organ company	267.2
New-England organ company	268.2
H. F. Miller pianos	268.9
Hook & Hastings' standard	270
Weber pianos	270.3
Thomas's pitch, 1879	271.1
Music-Hall organ	271.2
Steinway's pitch	272.2
Highest New-York pitch	273.9

The standard used by the Boston symphony orchestra in 1882–83 was an A-fork of 448 double vibrations; that used in 1883–84 was a French A of 435 vibrations. The standard French pitch of the New-England conservatory of music is a middle C, a *true* sixth below the normal A, hence of 261 vibrations. Owing to the difference between the true and tempered sixths, the C-fork used with the orchestra which has A for its standard does not agree with this. Chickering and Miller have had C standard forks made which are a *tempered* sixth below the French A, making 258.7 vibrations, and which could therefore be used with the orchestra which has A for a standard. Thomas's present pitch is an A a little sharper than the French A. Comparing the highest New-York pitch given above with the standard in Handel's time, when the C-fork had 249.6 vibrations, the difficulty of singing some old music is readily understood. —— Mr. A. P. Browne explained the Deerfoot safety milk-can, by which the introduction of any adulterating substance into the can is rendered impossible, while the thorough mixing of the milk and cream is insured every time any milk is drawn out.

NOTES AND NEWS.

SEVERAL members of the New-York legislature, from the western part of the state, a year ago called the attention of their state board of health to the necessity of draining certain large, swampy, and miasmatic lands that lie in a shallow trough on the back of the hard Niagara limestone between Rochester and Niagara. In response to their memorial, Mr. Gardiner, director of the state survey, was requested by the board of health to make an accurate topographical map of the district, and to report upon a plan by which it could be drained; and accordingly sur-

veys were actively carried on last summer, with a result now presented in Mr. Gardiner's 'Report on the drainage of the Tonawanda and Oak-Orchard Swamps,' in the fourth annual report of the board of health, just issued. The two swamps are connected, but only the latter or eastward one was thoroughly examined. It is long and narrow, with irregular margins, covering an area of twenty-three thousand acres. Although nearly level, it has a sufficient slope for drainage from the sides towards the middle, and from east to west following the creek, which leaves it at the western end; but, on account of the resistance of the hard limestone over which the outlet flows, it has failed, as yet, to cut a passage deep enough to dry the ground, or wide enough to discharge the spring rains and melting snow. The report contains valuable discussions of the rainfall of western New York, of the ratio between rainfall and stream-discharge (taken largely from the invaluable reports on the Cochituate and Sudbury water-supplies for Boston), and of the proper size and slope for discharge-channels: it is accompanied by maps and sections. If legislators in other states, contemplating the advisability of establishing a survey of their domains, would examine p. 3 of this report, they would find the encouraging statement that it is "necessary to secure, as a basis for any adequate plans and propositions for successful drainage, *an accurate topographical map.*"

— The organization of the Yale college observatory is now proceeding quietly. The control of the observatory will come directly under the corporation, the old board of managers being abolished. The bureaus of horology and thermometry, on account of their outside relations, will be placed on a business basis.

— The American institute of electrical engineers, recently organized in New York, consists of members, honorary members, and associates. Members and honorary members are professional electricians and electrical engineers. Associates include persons practically engaged in electrical enterprises, and all suitable persons desirous of being connected with the institute. All members and associates are equally entitled to the privileges of membership.

At the meeting, May 13, officers were elected as follows: president, Norvin Green; vice-presidents, A. Graham Bell, Charles T. Cross, Thomas A. Edison, George A. Hamilton, Charles H. Haskins, Frank L. Pope; managers, Charles F. Brush, William H. Eckert, Stephen D. Field, Elisha Gray, Edwin J. Houston, G. L. Hillings, Frank W. Jones, George B. Prescott, W. W. Smith, W. P. Trowbridge, Theodore N. Vail, Edward Weston; treasurer, Rowland R. Hazard; secretary, Nathaniel S. Keith. —— A letter was read from C. J. Kintner, of the patent office, deprecating the large surplus turned into the U. S. treasury each year by the office, especially in view of the press of new inventions, which, in the electrical department, are now four months behind. —— Resolutions were passed, pledging the influence of the institute "to prevent any restriction of the rights and privileges of inventors, as they now exist under the laws, and that the institute of electrical engineers earnestly desires the passage of Senator Platt's bill, or its equivalent, in order that the work of the patent office may be put on a more efficient footing." —— Mr. Isaac Trumbo of San Francisco made some remarks on the state of electric lighting on the Pacific slope, and stated that he had been investigating various systems of lighting for use in the west.

— The sixteenth and seventeenth annual reports of the trustees of the Peabody museum have just been published in one volume. The curator, Prof. Fred. W. Putnam, gives the results of his important discoveries, made in 1882 and 1883, in certain mounds in Madisonville, in the Little Miami valley, Ohio, as well as of the explorations of others in Tennessee and Wisconsin, and of shell-heaps upon the coast of Maine. The Madisonville mounds have disclosed the interesting fact, that their builders made use to a limited extent of meteoric iron for the manufacture of ornaments, as is proved by the careful analysis given by Dr. Kinnicutt. Of even greater interest is the discovery of a series of pits, provided with flues, which appear to have been employed for the purposes of cremation, although Miss Fletcher has suggested the possibility that they were caches for storing valuables, which could be burned when liable to be captured by enemies. Mr. Putnam makes an almost passionate appeal to the patriotism of the American people for the preservation of the more important of the fast-disappearing relics of the remote past of their country. These reports are enriched by five most valuable papers by Miss Alice Fletcher, giving complete and heretofore unknown information in regard to the religious belief and the ceremonial observances of different Indian tribes. Mr. Carr has added an exhaustive examination of the social and political position of woman among the Iroquois, establishing incontestably the preponderating influence wielded by her. There is also a thoroughly scientific study by Miss Studley, with complete tables of measurements, of the osteology of human remains brought by Dr. Palmer from four caves in Coahuila, Mex. Lastly, Dr. Barrett has given interesting notes of his observations of numerous instances of dental disease occurring in ancient crania of the extensive collections of the museum. We regret that we have not space to give such an account as they merit, of these reports, which equal, if they do not surpass, in importance, any of the valuable contributions which Mr. Putnam has made to our knowledge of American antiquities.

— The summer course in botany, from July 7 to Aug. 16, at the botanic garden of Harvard university, Cambridge, Mass., will be given by Professor Trelease, of the University of Wisconsin. This course of lectures is designed to present, in a familiar way, the more important principles of botany of flowering plants. The elements of morphology, microscopic anatomy, and physiology of plants will be illustrated in the lecture-room by living specimens, by demonstrations and experiments. Laboratory work of two kinds will be provided, — 1°, for beginners; 2°, a course of laboratory practice for advanced students, comprising demonstrations in microscopic anatomy

and development, special attention being given to the study of cryptogams. The fees for lectures and laboratory practice will be twenty-five dollars. Applications for places in the laboratories should be made to Prof. G. L. Goodale, Cambridge, before July 6.

— Old Providence Island, recently visited by the U. S. fish-commission steamer Albatross, was in old times the favorite resort of buccaneers; and the ruins of their fortifications, even some of their ancient cannon, are still to be seen. A glance at the beautiful little harbor of Catalina and its surroundings reveals the wisdom of its selection as a rendezvous by the lawless freebooters. The island is entirely surrounded by dangerous reefs, the entrance to the harbor being narrow, somewhat tortuous, and commanded by their batteries on shore. Ample supplies of wood, water, fresh meats, fruit, and vegetables, could be procured from the inhabitants, with whom they made it a point to be on friendly terms. Its location near to, but outside, the great routes of commerce, made it particularly valuable for their purposes.

The island belongs to the United States of Colombia, and has a population of about eight hundred, the Indian blood predominating; but there is a large African element. The English language is universally spoken, and the Protestant religion is the only one professed by the people. Schools are maintained, and it is the exception when a native is unable to read and write. The climate during the dry season, from November to May, is tempered by the trade-winds, which blow constantly, and is probably unexcelled by that of any island in the West Indies. There is no physician on the island, and the lack of proper medical attendance causes great suffering among the inhabitants. Dr. Herndon had a room fitted up on shore, and gave his whole time to the sick who came or were brought to him, the ship furnishing such medicines as could be spared.

As soon as they anchored, an officer was sent on shore to call on the magistrate, and to inform him of the mission of the Albatross. He received the officer very cordially, and offered every assistance in his power. The naturalists commenced work at once, and succeeded in making a very creditable collection. A large variety of fish was procured for specimens, and an ample supply for officers and crew was caught with the seine. Fresh beef, poultry, sweet-potatoes, yams, and fruit were plentiful at fair prices. Tortoise-shell and cocoanuts are articles of export.

— The German foreign office means to send a commissioner to the west coast of Africa, on whose report it will depend whether a German man-of-war shall be stationed in those waters, or not. Dr. Nachtigall, the German consul in Tunis, has been intrusted with this mission. He will be accompanied by Dr. Büchner, the explorer, and by a member of the German embassy in London. The gunboat Möwe has been sent there to supersede the corvette Sophie.

— The German government has awarded 135,000 marks to Dr. Koch for his services on the International cholera commission.

— The German iron and steel industry society is publishing an illustrated work on the uses of iron and steel in the building-trade, giving full directions for any workman to apply for himself. The expenses will amount to £1,750, and the members of the society call upon all interested in the iron-trade to contribute towards them.

— From *Nature* we learn that the electrical congress of 1884 adjourned, after deciding on the standard value of the ohm as satisfactorily as may be at present. It must, however, be considered as little short of disappointing, that no better standard of light could be suggested than that emitted from a square centimetre of platinum at the temperature of fusion; and in requesting that "the results of observations (of earth-currents) collected by the various administrations be sent each year to the International bureau of telegraph administration at Berne," the committee simply stated that they had nothing to report. M. Mascart grouped the results of ohm determination in the following useful table: —

Methods.	Experimenters.	Column of mercury in centimetres.
1. B. A.	British Association	104.83
	Rayleigh-Schuster	106.00
	Rayleigh (1882)	106.27
	H. Weber	106.16
2. Weber (I.)	Kohlrausch	105.81
	Wiedemann	106.19
	Mascart	106.33
3. Kirchhoff	F. Weber	105.02
	Rowland	105.79
	Glazebrook	106.29
	Mascart	106.33
4.	Rôiti	105.90
5.	Fr. Weber	105.33
6. Lorenz	Lorenz (first)	107.10
	Rayleigh	106.24
	Lenz	106.13
	Lorenz (second)	106.19
7. Weber (II.)	Dorn	105.46
	Fr. Weber	105.26
	Wild	105.68
	Baille	105.37
8. Heat	Joule	106.22

From this it appears that the figures obtained by the different methods were —

B.A.	106.21
Weber's (I.)	106.14
Kirchhoff's	105.93
Lorenz	106.19
Weber's (II.)	105.47
Joule	106.22

the mean of which was 106.02; but 106 was taken as a round figure, sufficiently near the truth for all practical and useful purposes: hence the congress decided that "the legal ohm should be the resistance of a column of mercury of one square millimetre section, and of 106 cm. of length at the temperature of freezing."

— Among those granted prizes this year by the French academy were, in geometry, Emile Barbier; in mechanics, Marcel Desprez; for his experiments

on electric transmission of power, in astronomy, Bouquet de la Grye, de Bernardières, Courcelle-Seneuil, Fleuriais, Hatt, Perrotin, Bassot, Bigourdan, and Callandreau, for their observations of the transit of Venus in 1882; Stephan, the Vally prize; in physics, Henri Becquerel; in chemistry, Etard and L. Cailletet, for his researches on the liquefaction of gases; in geology, Fontannes for his work on the basin of the Rhone, and Péron for his account of the geology of Algeria; in botany, Joannès Chatin for his studies of trichina, and G. Bonnier, L. Mangin, Klein, Ch. Maguier, Costantin; in physiology, Paul Regnard, and Balbiani; in aeronautics, Gaston Tissandier, Duroy de Bruignac, and V. Tatin.

— The following resolutions were passed at the Ornithological congress of Vienna: 1°. The chase, capture, and trade of birds of passage and their eggs should be forbidden during the second half of the winter and in the spring; 2°. All wholesale capture of birds of passage, and trade in them, should be forbidden, except during the hunting-season.

Dr. Karl Russ of Berlin received the highest honor diploma of the congress, for his works on bird-keeping, canaries, parrots, and his journal called the *Feathered world.*

— Parts xxvi. and xxvii. of Bütschli's 'Protozoa' have just appeared, and nearly complete the Flagellata. Kent's unsatisfactory classification is set aside for a new and more scientific system. Nearly two hundred species are known, divided into a hundred and ten genera. Bütschli reduces the number of genera, which might otherwise soon exceed the species, and establishes the following sub-orders: Monadina, Englenoidina, Heteromastigoda, and Isomastigoda. Although the work was originally planned to be complete in fifteen parts, and twenty-seven have already appeared, the Infusoria, and the general chapter on the Protozoa, are still to come.

— The *Illustrirte zeitung* states that the recommendations of the German cholera commission are being put in force at Hyderabad, especially with reference to the water-supply; the reform being hastened by the young Nizam having an attack of cholera.

— The death of Dr. Paul Pogge, the celebrated African traveller, is a loss to the German-African exploration society. He started from Loanda with Lieut. Wissmann; from Nyangure, on the Kongo, he returned, sending his companion to Zanzibar; from Loanda he meant to start on fresh explorations, but died.

— The last (fifth) report of the Archaeological institute of America is principally occupied with an account of the explorations, carried on for the society last year by Mr. Bandelier, in New Mexico and Arizona. An excellent map illustrates his various routes; and, in an extended report, he gives the conclusions he has drawn mainly from his architectural studies, of the different ruins investigated. He finds a well-defined system of growth from the temporary Indian lodge, to the many-storied pueblo building, which clearly does not owe its origin to any external influence. Mr. Bandelier is now in the mountains of northern Mexico, seeking for traces of any possible connection between the ancient Pueblos and the Aztecs; and it is announced that the report of his important studies in Mexico, in 1881, at Cholula and at Mitla, is nearly ready for publication.

Of the work in classical archeology, carried on by the institute, an account is given of the conclusion of the explorations at Assos, in Asia Minor, owing to the expiration of the three years' firman granted for that purpose. The main efforts of the past year have been expended upon the Agora and the Necropolis. A fair division of the objects discovered was arranged with the agent of the Turkish government; and two fine bas-reliefs from the temple of Athena, the human-legged centaurs and the heraldic sphinxes, have been received by the Museum of fine arts in Boston. Mr. Clarke is now in London, preparing a complete report of the explorations. The total cost of this expedition, so important for the knowledge of classical antiquity, and so honorable to American scholarship, has been a little more than nineteen thousand dollars. Appended is the third annual report of the committee on the American school of classical studies at Athens.

— Ostrich-farming is a new business, unknown till the English colonies of South Africa realized such wonderful results. We have already given some statistics of their enormous increase. The ostrich lays a minimum of forty, a maximum of sixty, eggs in a season, weighing about three pounds each, and which are laid in the sand, and left to hatch in the hot regions; but in cooler regions the male and female birds sit on the nest by turns, defending it with great courage. Forty days is the time for incubation. Since the importation of domestic ostriches into the United States, the South African farmers have become fearful of losing their great profits in case of a successful competition springing up.

— The *Academy* announces the death of Señor Don Eulogio Jimenez of the observatory at Madrid, one of the first mathematicians of Spain, and author of '*La teoria de los numeros*' and many educational works on mathematics, both original and translated.

— A coal-steamer, the Loch Garry, has left St. John's with five hundred tons of coal for the Greely search party, and materials for a house; these supplies to be landed on Littleton Island. The Bear got away from St. John's before any of the whaling-fleet, except the Norwhal, a slow vessel. The Thetis will convoy the coal-steamer as far as possible; and, in case of separation, they are to meet at Disco.

— The French association for the advancement of science will hold its thirtieth meeting in the town of Blois, from Sept. 4 to 11.

— The Franklin institute wishes to make a loan-collection of pieces of electrical apparatus of historic interest, one feature of the approaching electrical exhibition, and has issued a call to those having such pieces to send them to Philadelphia, where the proper care is guaranteed. Edwin J. Houston is the chairman of the committee on the historical electrical apparatus.